Teamwork in action

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Military teams preparing for, and conducting Peace Support Operations

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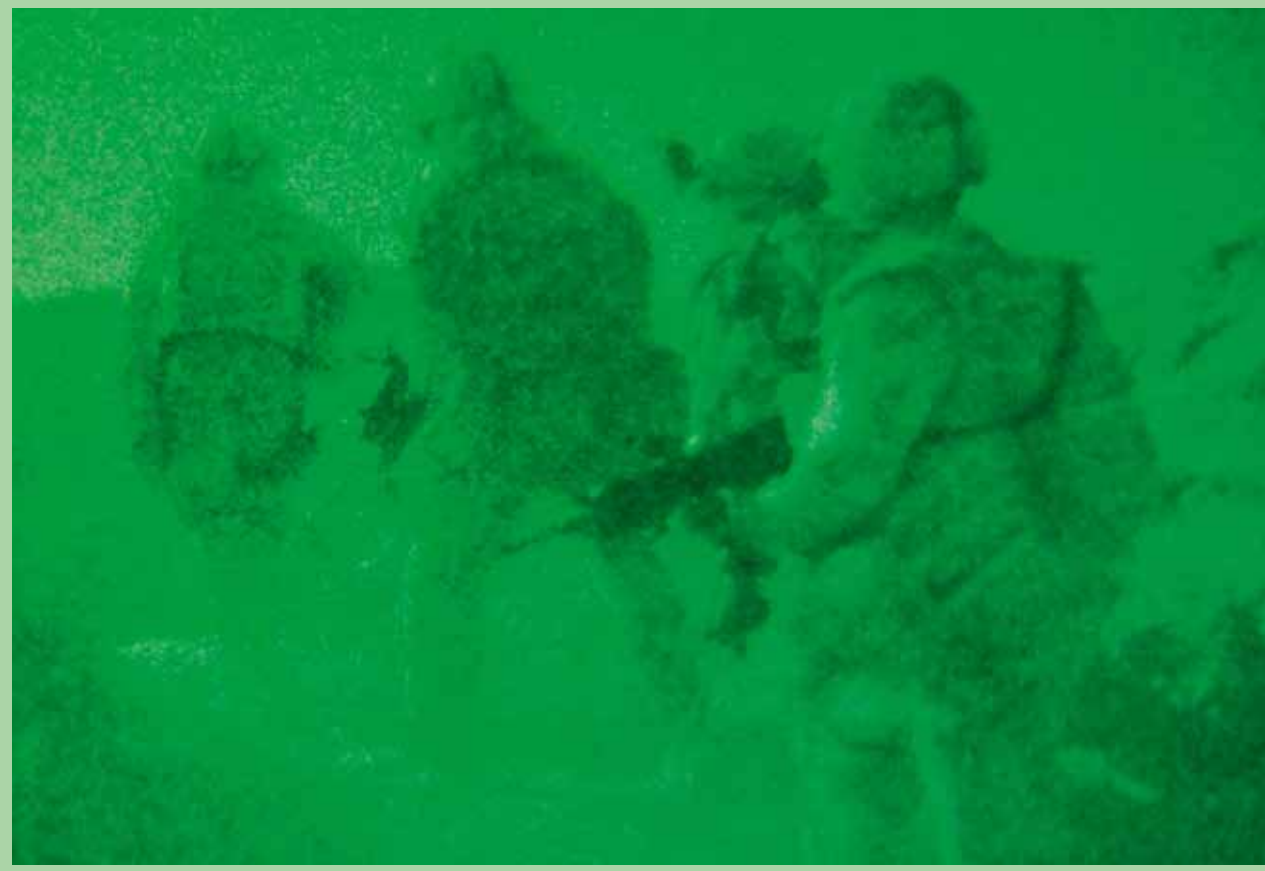

Jacco Duel

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Teamwork in *action*

Military teams preparing for, and conducting Peace Support Operations

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Preface and acknowledgements

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This book is about teamwork in military teams. My first experience with teamwork in the military stems from the end of 1980. On a cold and misty November morning I stood among a group of young people. We were surrounded by all sorts of material, such as oil-drums, poles, and pieces of rope. We listened to an Army officer who ordered us to cross several obstacles as a group, within a limited amount of time. We were allowed to use the material when crossing the obstacles, but we had to take all of it with us.

The officer's task was to determine whether we were capable working together with other people, and whether we had leadership skills. All of us had applied for a job as officer in the Royal Netherlands Army and this test was one of a series of tests each of us had to pass. Since applicants for the jobs were abundant but the jobs available were very few, only some of us would be lucky enough to pass the entire selection procedure. Nevertheless, both my "competitors" and I realized that we needed each other when crossing the obstacles. For example, the material posed us for several problems. Each oil drum too heavy for one man to lift, each of the poles too short to bridge the gaps, … We had to make a plan together, execute it together, coordinate each other's actions, and adjust our plans when things went wrong in order for all of us to successfully cross the obstacles with all material. Although "competitors" we shared the same goal, and we had to work as a team, which we did.

I managed to get through that test. In fact, I managed to get through all tests. So, in August 1981, I started the officer's training in Breda. It was the start of a long stay in the Royal Netherlands Army. An extraordinary organization in which I mostly worked in teams or commanded them. Most teams were very successful with great fun to work in or with. Some of the teams, however, were nothing less than a disappointment, with people, for example, being more busy in fighting each other than in pursuing the team goals. As a result, teams did not accomplish their tasks, and people left the teams or got frustrated. Still, on balance, I have positive feelings about teamwork in the military.

I think most people in the military will have experienced working in teams like I did. Some teams worked, some did not. But why is that so? It puzzled me. That is why I decided to focus my study on teamwork to learn more about that.

This book is the result of that study on teamwork. At the same time, this book marks the end of a long period of studying. That period started in 1983 when I tried to obtain my "vwo" diploma. First, by studying at home with packages of study material that were sent to me by several institutions for years. That did not work. So, at the end of the 1980s, I went to school in the evening after being at work during the day. It took three years, but I succeeded. This experience also changed me in some way. I learned to like studying and gradually it took less effort to study. I continued studying … The Royal Military Academy, psychology at the Open University, and finally this dissertation.

This study on teamwork took about four and a halve years from start to finish, besides working, and being a husband and father. During that time I received the support of several people that was invaluable for me. Therefore, I would like to thank some people who supported me. First, I would like to thank my supervisor Sjo Soeters. I met you in the mid-1990s when I studied at the Royal Military Academy. You inspired me with the way you taught social sciences … being well informed, giving lots of practical examples, and with passion, flair, and enthusiasm … During this promotion you broadened my view. You encouraged me not to stay on familiar grounds (as far as the terrain of organizational psychology was already familiar for me) but to explore other scientific fields as well. Moreover, you stimulated me to not only present the "facts and figures" in my writing, but to explain the results of the study in a readable text that would be highly recognizable and accessible for the practitioner. Although I did not succeed completely as you would have liked, I guess, I see it as a challenge to improve on that. Second, I would like to thank my co-supervisor Ad Vogelaar. We also met in the mid-1990s at the Royal Military Academy. I learned to know you as an amiable and cheerful person. At the Royal Military Academy, we closely worked together since you supervised me when I wrote my research report at that time. During that time, and during the time you supervised me on this study, I admired your formidable knowledge on each topic we encountered. Moreover, then and now, you learned me to see the wood for the trees. Sometimes, I was so caught up by the figures and facts that I failed to see the 'bigger picture'. On several of those crucial occasions when I got stuck, you helped me with your expertise and insightful comments, so I could get along. Next, you helped me extensively in rewriting several texts. It's not easy to get rid of thousands of words when you carefully thought about each of them. Nevertheless, with your help I succeeded. Third, I want to thank my co-supervisor Renier van Gelooven. You also supervised me at the time I had to write a thesis at the end of my psychology study, in 1998. I still have the copy of one of the earlier versions of that thesis, with a small picture of a battle tank glued on it, accompanied with the writing "well done". Although the picture was meant as a joke, the message that accompanied it was an important compliment for me. We have worked closely together since 2004 until now. I always admired your knowledge on research methods and technologies. Luckily, I could learn a lot of that during my study. Moreover, you learned me to think more structured when tackling research problems. In addition, you offered me the opportunity to write a part of my dissertation during the working hours. Besides the things you three learned me, I want to thank all three of you for the most pleasant way you supervised me. Thanks!

Next I want to thank my – former – colleagues at the Behavioural Sciences Services Centre (Gedragswetenschappen) in The Hague. Whether it was a small talk about "how I was doing" during the process, or a long talk about path coefficients in Structural Equation Models and how to interpret several results, it was always stimulating.

Last, but definitely not least I want to thank Petra, Aart, Jaap and Silke. "Promo-en", as you called it, took a lot of time and energy. However, neither of you ever complained when I buried myself in books or articles, or when I was physically present, but mentally absent, staring for hours at figures on my computer screen. Petra, you always believed in me and supported me all the way. I cannot thank you enough for that.

Ermelo, 2010.

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Military teams preparing for, and conducting Peace Support Operations

Jacco Duel

1.
Teamwork in the military

1. Teamwork in the military

1.1 The importance of teamwork for the military

On January 6, 2007, a Dutch infantry team was ambushed near the Beluchi valley in the southern province of Uruzgan, Afghanistan. The moment the team received fire, it quickly adapted to the new situation. Each team member automatically switched into the "drill mode", knowing exactly what to do and what to expect from other team members. In addition, the team leader assigned each team member a sector to observe and to fire when necessary. Moreover, the team leader assigned additional tasks considering the situation at hand. The team members responded without questioning. 'You do as ordered', one of them explained afterwards. 'The team leader is experienced and knows his stuff. We trust him'. The information the team received by radio about the opposing militant forces was passed around the team. 'You have to have that information', another team member explained, 'otherwise you don't know what's happening'. 'And', he added, 'we closely monitored each other, and we helped each other. That happens automatically. You don't let your buddies down. It was one for all, and all for one. This experience made me feel good afterwards'. The fight took approximately sixty minutes. At one point in time the opposing militant forces neared at 50 yards. 'We had to fight real hard' a team member said. 'Ultimately, we managed to get out with the fire support of Apache helicopters. Afterwards, in the "debrief" we were told we did well. That boosted our self-confidence. Of course, there were minor things we could have done better next time, but there were few'.[1]

These team members described their team functioning as a well oiled machine. One could argue they better should be, because they are professional soldiers and well prepared for this kind of situations. After all, before deployment to Uruzgan, they took part in an extensive training program that lasted a year or maybe longer. They learned their skills and drills as individuals and as a team. Still, this is no guarantee for success. For example, in October 2008, in the Dutch newspapers articles appeared which stated that the task force commander in Uruzgan had placed a reconnaissance platoon on non-active.[2] This platoon consisted of several teams, each with professional soldiers that were well prepared for their task as well. So, what had happened? It was suggested that personnel had disobeyed orders, which is a serious offense in the military. A judicial investigation started, of which the results were reported shortly afterwards. Unfortunately, few is publicly known about this affair. The answers the Minister of Defence wrote to the Parliament in response to their questions on this topic revealed no details.[3] It said that 'internal lack of trust and misunderstandings' caused the problems. As a consequence, 'two (non-) commissioned officers were sent home. Moreover, the teams were disbanded and personnel was divided over the remaining units'. Apparently there was no basis for further cooperation in the teams.

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[1] This section is a reconstruction of an interview of the team members that took part in – what the military refers to as – a TIC (i.e. an abbreviation for troops in contact, which is an euphemism for a combat action). The interview is published as "Omgaan met TIC's: soldaten Battlegroup vertellen hun verhaal", in Rinoceros, number 2, 2007. Rinoceros is the journal of the 13th Mechanized Brigade of the Royal Netherlands Army.

[2] For example http://www.volkskrant.nl/binnenland/article1071547.ece/Weigeren_dienstbevel_ is_niet_de_reden and http://www.nrc.nl/nieuwsthema/uruzgan/article1998645.ece/Peloton_in_ Uruzgan_op_non-actief_gesteld. Both retrieved on 7 December 2008.

[3] Letters to The Parliament from the Minister of Defense, 20 October 2008, numbers D/2008027145 and D/2008027149.

Two examples. One of a team that worked well and the other of teams that did not work well. The ability to work together as a team is highly valued in the military. The army is about teamwork, the British military, for example, says.[4] Or, according to the Royal Netherlands Army and the United States Army, as a soldier you are always part of a team.[5] Everybody, from soldier to general has his or her responsibilities in the team. Being part of a team means that your colleague's life may depend on your actions. Therefore, team members must be able to trust each other almost blindly, which creates a kind of "group-feeling", a phenomenon that is unique for the military.[6] To experience this feeling as a civilian, the United States Army, in cooperation with software companies, developed the Xbox 360 ® video game 'America's Army: True Soldiers', in 2007.[7] This multiplayer online game "accurately portrays the values that guide soldiers in the U.S. Army, by specifically incorporating gameplay based on mission accomplishment [and] teamwork […]."[8]

Although civilians may experience military teamwork behind a computer screen at home, military teams operate in real and dangerous circumstances. Nowadays, most military teams train for, or are deployed in Peace Support Operations. These operations cover a wide range of types of military operations, such as providing humanitarian aid, providing security to a threatened population, assisting a government in training military personnel or police officers, or by combating forces that oppose the legal government. Troops that conduct Peace Support Operations may be involved in actions that fit several categories just mentioned, on one single day. For example, troops participating in the International Security Assistance Force in Afghanistan may have been busy building or reconstructing a bridge or school, but when returning to their Forward Operating Base, may get ambushed by Opposing Militant Forces, leading to fierce fighting.[9] For military personnel being deployed in Peace Support Operations, the working and living conditions can be harsh and stressing (Bartone, 2006). For example, in the period from mid-2006 until the beginning of 2008, the Dutch troops in Uruzgan engaged in over 600 fire contacts with Opposing Militant Forces.[10]

[4] Retrieved from http://www.army.mod.uk/structure/about/3733.aspx on 5 September 2008.

[5] See respectively Netherlands Ministry of Defence, Dagorder Commandant der Strijdkrachten, 3 April 2007, and http:// http://www.tradoc.army.mil/pao/TNSarchives/September04/092304.htm retrieved on 24 November 2009.

[6] Retrieved from http://www.werkenbijdelandmacht.nl/index.html?cid=27&l1=7&l2=50&l3=60 on 18 March 2006. The British Army shares the same view. "Never take for granted the ties of teamwork and loyalty you've forged in the Army. Your officers and NCOs will look out for you in ways that go far deeper than a relationship between employer and employee. And your mates are not simple co-workers; they're the comrades with whom you trust your life, and they expect the same loyalty in return. The friendships you're making in the Army will stay with you for the rest of your life. […]You will find absolutely nothing like it in the outside world." Retrieved from http://www.doingalright.army.mod.uk/team.aspx&usg=__sikAJbw18F79xnn9BqAUdJMw OSg=&h=335&w=792&sz=64&hl=nl&start=24&um=1&tbnid=SA-UYzWpkDR48M:&tbnh=60&tbnw=143&prev=/images%3Fq%3Dteamwork%2Buk%2Barmy%26start%3D20%26ndsp%3D20%26um%3D1%26hl%3Dnl%26sa%3DN, on 3 December 2008.

[7] Defensiekrant, Number 30, 23 August 2007.

[8] Retrieved from http://news.teamxbox.com/xbox/13680/Americas-Army-True-Soldiers-Announced/, on 3 December 2008.

[9] The Forward Operating Base is a highly guarded barracks with sleeping and working facilities, dining facilities, and mostly with shops, sports facilities, and welfare and recreation facilities with internet and phone lines. A Forward Operating Base usually lies amidst the area of operations and military operations are launched and logistically supported from it (Wong, Kolditz, Millen, & Potter, 2003).

[10] See http://www.nrc.nl/nieuwsthema/uruzgan/article1874775.ece/We_wisten_niet_dat_we_ zo_vaak_moesten_knokken, visited on 7 December 2008.

Teams that do not function adequately in those situations may cause more unnecessary casualties within and outside the team than teams that function well (Wilson, Salas, Priest, & Andrews, 2007). So, effective teamwork is a critical mission success factor (Essens et al., 2009). Therefore, it is important to provide the teams that prepare for, or conduct Peace Support Operations with the best available guidance on how to work together effectively.

So what do we know about the impact of teamwork on team effectiveness of military teams? And what do we know about teamwork that can help teams as described at the beginning of this chapter to sustain high team performance and prevent deterioration, especially when working in difficult circumstances?

1.2 Research into the functioning of military personnel and small military units

Throughout the years, research has provided many insights in aspects that affect the performance of military personnel and small military units. For example, several landmark studies appeared that investigated the behavior of men in battle in the First World War (e.g., Ellis, 1989; Lord Moran, 1945/2007; Winter, 1979), and the Second World War (e.g., Gray, 1998; Marshall, 1947/2000; McManus, 1998; Van Creveld, 1982). Other researchers conducted studies on the behavior of men in battle in various time periods (e.g., Holmes, 1989; Keegan, 1997; Keegan & Holmes, 1985; Watson, 1997).

Besides these studies, numerous books and articles appeared that took a more thematic approach. An important theme throughout the years is *cohesion* (Fowler, 1979; Gabriel & Savage, 1978; Henderson, 1985; Ingraham & Manning, 1981; MacCoun, Kier, & Belkin, 2006; Manning, 1991, 1994; Shils & Janowitz, 1948; Stewart, 1989). In their classic study on the behavior of German soldiers fighting in the Second World War, Shils and Janowitz (1948), found that it was the bonding among soldiers within primary groups that enabled soldiers to sustain in combat, and not to surrender, even when the odds were against these soldiers. A finding that was echoed by Gabriel and Savage (1978) when they studied the disintegration of the United States Army fighting in Vietnam in the late 1960s, early 1970s.

Other important themes are *morale* (e.g., Britt & Dickinson, 2006; Britt, Dickinson, Castro, Moore, & Adler, 2007; Gal, 1986; Griffith, 2002, 2007), *leadership* (e.g., Essens, Vogelaar, Tanercan, & Winslow, 2001; Frame & Lussier, 2000; Johnson, 1999; Kolditz, 2007), and the *effects* of military operations *on the well-being* of military personnel (e.g., Campion, Hacker Hughes, Devon, & Fear, 2006; Hoge et al., 2004; Hotopf et al., 2006; Litz, 2007; Marlow, 2001; Rona et al., 2006; Shay, 1995).

In the Netherlands, research on the behavior of military personnel under operational circumstances has been conducted as well. With some studies being conducted before the mid-1990s (e.g., Roozendaal, Cortenraad, & Roemers, 1984; Turpijn, 1980), the amount of research increased from that point. The main reason for this growing research interest was the deployment of military troops in Peace Support Operations. These deployments, and the growing idea in the Netherlands' military that taking part in Peace Support Operations would be "core business" instead of something extraordinary, started research with the aim of getting a firm understanding of what it meant for soldiers to operate under difficult circumstances.

In recent years, for example, Duel (2008), Duel and Van Rees Vellinga (2009), Op den Buijs (2001, 2004), Rietveld (2009), Schok (2009), and Sandbergen and Duel (2008) studied the *effect* of working and living conditions of military personnel *on their well-being*. Other researchers studied the *effect of death threat* on soldiers (Dechesne, Van den Berg, & Soeters, 2007; Soeters, Van den Berg, Varoğlu, & Siğri, 2007; Van den Berg, 2009; Van den Berg & Soeters, 2009) or what it means for soldiers to *switch between* "warrior" and "peace keeping" *roles* when being deployed in Peace Support Operations (Broesder, 2008). Other research focused on *leadership* (e.g., Resteigne & Soeters, 2009; Soeters, 1998; Vogelaar & Kramer, 2004; Vogelaar & Kramer, 1997; Vogelaar et al., 1997), *team learning* (Bijlsma, 2009), or *trust* within military units (Van der Kloet, 2005; Van der Kloet, Van Schuur, & Sanders, 2001).

A fine example of applied research in the Netherlands' military is the morale research conducted by the Netherlands' Defence Behavioural Sciences Services Centre.[11] This research deserves special attention. First, because all units that prepare for deployment, or are deployed, participate in it.[12] Second, because the teamwork study that is the subject of this book, used morale research as a 'vehicle' for being conducted (see Chapter 4).

In the Netherlands' Defense Doctrine, maintaining a high level of morale is considered as critical to military effectiveness and readiness (Defensiestaf, 2005). Morale is the enthusiasm and persistence with which a member of a group engages in the prescribed activities of that group (Manning, 1991). High morale impairs the development of (battle) stress among military personnel during military operations (Manning, 1991; NATO workgroup HFM 081/RTG, 2007). Moreover, high morale increases the level of performance of military personnel (Gal & Manning, 1987; Manning, 1991; NATO workgroup HFM 081/RTG, 2007). Because of the positive influence of high levels of morale, commanders and (military) social scientists are interested in the factors that influence the morale of military personnel and military units.

Since 1999, the Netherlands' Defence Behavioural Sciences Services Centre assesses the morale of operational units in order to advise military leaders how to manage their units more effectively. Morale is assessed before and during deployment using a survey. The survey is based on international (military and industrial) morale literature. It consists of 21 aspects that have been found to affect morale and that can be addressed by leaders in order to improve morale when necessary.

Each morale research starts with the researchers informing the unit commander about the purpose of the research, the way it will be conducted, and the time schedule to be followed. In addition, the unit commander is asked whether specific circumstances may influence, or may have influenced the unit's morale. These specific circumstances may be incorporated into the survey. Unit commanders themselves are responsible for conducting the study. They are provided with the questionnaires and instructions how to conduct the study. Because commanders organize the study themselves, they may provide a signal to their personnel that they regard the study as important.

[11] This part on morale research is based on Van Boxmeer, Duel, De Bruin, and Verwijs (2008), Van Boxmeer, Verwijs, and De Bruin (2007), and Van Boxmeer, Verwijs, De Bruin, Duel, and Euwema (2007, 2008).

[12] See Letter from Commander Armed Forces (2008).

The results of the survey are reported to the unit commander within one or two weeks following the survey. The researchers report the results of the unit's morale and the factors influencing it, and discuss the results with the unit commander. Together with the unit commander, the researchers develop interventions that may improve morale within the unit, when necessary.

Although behavioral research in the military has revealed a wealth of information on topics such as leadership, morale, and cohesion, to mention a few, teamwork in military teams as such has received modest research attention (for an overview of team research in the military see Blickensderfer, Salas, & Cannon-Bowers, 2000; Dyer, 1984; Salas, Bowers, & Cannon-Bowers, 1995). This is curious since McIntyre and Salas (1995) state that the importance of teamwork in the military cannot be exaggerated, and, according to Salas, Sims, and Burke (2005) it is teamwork that ensures the success of the team.

1.3 The study of teamwork outside the military

Outside the military, teamwork has been studied extensively in recent years. Most researchers refer to teamwork as a multi-faceted component that subsumes several attitudes, behaviors, and cognitions that foster the interaction among team members so teams can be effective (e.g., Hoegl & Gemuenden, 2001, Kozlowski & Ilgen, 2006). Despite teamwork being studied extensively, research on teamwork has not provided straightforward results. There are five problems that impede a clear answer to the questions what good teamwork is about and how it is sustained over time.

First, there is a lack of consensus on the *dimensionality* of teamwork (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). This may be the consequence of "[m]any researchers [pursuing] their own work without any attempt to build on and integrate the work of others" (Rousseau, Aubé, & Savoie, 2006, p. 543). In their attempt to integrate several teamwork models, Rousseau et al. (2006) focused on teamwork behaviors. Teamwork behaviors are what Rousseau et al. (2006) regarded as the observable aspect of teamwork, for example cooperation, communication, or coordination. Rousseau et al. (2006) found that models of teamwork behaviors varied from two to ten teamwork behaviors per model.

The second problem, related to the former is that there is inconsistency in *defining and labeling the constructs* that are supposed to subsume teamwork (Cannon-Bowers et al., 1995; Rousseau et al., 2006) and at the level of individual studies there is item overlap between measures of constructs (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). For example, based on their research, Cannon-Bowers et al. (1995) found more than 130 labels for teamwork constructs, which they summarized into eight categories and twenty-five sub-categories. Both problems imply that one should be careful in making inferences about the effect of "teamwork" on team effectiveness because teamwork may refer to different kinds of combinations of constructs. In addition, these constructs may resemble each other although they are labeled differently, or they may refer to different phenomena although labeled the same. Salas, Stagl, and Burke (2004) compared the situation in teamwork research nowadays, with the situation in personality research before consensus emerged about utilizing the five-factor structure, often referred to as the Big Five. "The Big Five are now viewed as the first and only scientific consensus in personality psychology. […] One of the most significant advances of the five-factor model was the establishment of a common taxonomy that demonstrates order in a previously scattered and disorganized field."[13]

[13] See: http://en.wikipedia.org/wiki/Big_Five_personality_traits, visited on 28 January 2009.

Third, although theories on team functioning abound in the literature (Paris, Salas, & Cannon-Bowers, 2000), there is *hardly any empirical evidence* for these theories (Salas, Stagl et al., 2004).

Fourth, related to that, when models are tested, this is mostly done in *experimental settings*, using ad-hoc groups without a past or future, stripped of a context, and with arbitrarily assigned tasks (McGrath, Arrow, & Berdahl, 2000). Although laboratory studies can be useful for building, testing, and refining theories, several limitations of laboratory studies may impair the generalization of the results from these studies to teams in organizations (Gully, 2000). Sundstrom, De Meuse, and Futrell (1990), for example, argued that the organizational context in which the team performs, may affect team effectiveness. Aspects of the organizational context, such as the organizational culture, rewards and recognition for the team and its members, training, and the physical environment in which the team operates (Sundstrom et al., 1990) are typically missing in laboratory settings. Both problems indicate that it is questionable whether the existing body of knowledge on teamwork has practical relevance for teams performing under real circumstances. Therefore, Salas, Burke, and Fowlkes (2006) and Salas, Cooke, and Rosen (2008, p. 544) advocated for teamwork research "in the wild", which means teams performing in their original context.

Fifth, there is hardly any theoretical or empirical literature available that provides insight on *what factors contribute to the team's ability to perform well over longer periods of time* (Houghton, Neck, & Manz, 2003; Milanovich, Salas, Cannon-Bowers, & Muñiz, 2000; Salas et al., 2005). The development of teams has received ample research attention, resulting in more than hundred models (Chang, Duck, & Bordia, 2006). However, in most models development is usually conceptualized as a rather linear process in which groups gradually and incrementally progress through predefined stages towards an optimal end state (Chang et al., 2006; Kozlowski, Gully, Nason, & Smith, 1999; McCollom, 1995; Morgan, Salas, & Glickman, 2001). Unfortunately, very little is known about what conditions trigger transitions (Arrow, McGrath, & Berdahl, 2000; McGrath, 1991). Especially, little is known about what factors may impair teams to sustain acceptable performance levels over time (Kozlowski & Bell, 2003).

1.4 Central research question

This study seeks to address the five problems mentioned above in an attempt to provide more insight into teamwork in the military. The first two problems will be addressed by focusing this study on a recent effort of several researchers who tried to establish order in a confusing body of knowledge on teamwork and who submitted a taxonomy of key competencies. This taxonomy is labeled the "Big Five in Teamwork" (Salas et al., 2005). According to Salas et al. (2005, p. 592) "the team literature as it currently exists has become unmanageable for any practical purposes". Their taxonomy is intended to provide more focus and practical guidance for practitioners in applied settings that design and facilitate teams. The remaining three problems will be addressed by conducting a longitudinal field study using military teams, performing real tasks in real, and demanding circumstances, which are Peace Support Operations. The central research question in this book is:

What effect does teamwork in military teams have on team effectiveness and how do military teams sustain their teamwork over time?

In order to be able to answer this central question, two research questions must be answered. These are:

1 **What knowledge, skills, and attitudes subsume teamwork and how are these knowledge, skills, and attitudes related to each other and to team effectiveness?**

2 **How does teamwork develop over time and what factors are of influence on that development?**

The results of this study may provide practitioners, such as team leaders and members and those who train and lead them, with insights on how to leverage team performance when preparing for, or when conducting, Peace Support Operations.

The question is whether the results of this study will apply to teams outside the military or teams that perform in other contexts as well. Although this topic will be elaborated in Chapters 2 and 7, it suffices to mention in advance that the results of this study are useful for teams that operate in dynamic situations and for teams in which members highly depend on each other's knowledge, skills, attitudes, and efforts in pursuing team goals.

1.5 Outline of the book

This book consists of seven chapters. Following this first introductory chapter, Chapter 2 will provide a review of the literature on teams, teamwork, team effectiveness, and team development. The review makes clear what we know about these topics, and what aspects are still unclear. The review results in several hypotheses, which will be presented in Chapter 3. Chapter 4 describes how the study was conducted in order to test the hypotheses. It describes what characterizes the population and respondents that took part in the study. Moreover, it presents the instruments that were used to collect the data. Chapter 5 presents the answer to the first research question, whereas Chapter 6 presents the answer to the second research question. Finally, Chapter 7 presents the answer to the central question, and discusses the theoretical and practical implications of the results of this study. In addition, Chapter 7 discusses some strengths and limitations of this study and it points at several avenues for further research. Further, Chapter 7 outlines the theoretical and practical contributions of this study.

2.
Teamwork and its development over time

2. Teamwork and its development over time

2.1 Introduction

One of the many definitions of teamwork in the literature is provided by Salas, Sims, and Klein (2004, p. 497-498), who state that "teamwork is a set of flexible behaviors, cognitions, and attitudes that interact to achieve desired mutual goals and adaptation to changing internal and external environments. It consists of the knowledge, skills, and attitudes (KSAs) that are displayed in support of one's teammates and the team's objectives.[14] Essentially, teamwork is a set of interrelated thoughts, actions, and feelings that combine to facilitate coordinated adaptive performance and the completion of taskwork objectives."

Although this definition may give the reader a 'feel' about what teamwork is about, it is still unclear *which* KSAs facilitate team members working together effectively on team tasks and how these KSAs are related to each other and team effectiveness. This chapter presents an overview of the team literature. Its purpose is to disentangle what we know about the KSAs that subsume teamwork, the way they influence each other and team effectiveness, how these KSAs develop over time and what factors influence that development. The findings of this review will be captured in several hypotheses that will be tested in this study.

Before going into detail on teamwork, however, the object of this study – the military team – will be defined. Teams come in different types, and teamwork within teams may differ between team types. Therefore, it is necessary to be clear about the team types this study focuses on and to what team types the results of this study generalize to. In addition, the context of teamwork will be outlined by presenting a general model of team effectiveness. The model describes how antecedent factors enable or constrain teamwork and how teamwork affects team outcomes (Mathieu, Maynard, Rapp, & Gilson, 2008).

2.2 The military team

In this research, the focus is on military teams. A comprehensive description of the military team is provided by Devine (2002, p. 303), who stated that military teams

> are small, formal units, that use lethal force (or the threat of it) to accomplish a variety of tasks associated with maintaining domestic order and ensuring national security [...]. These primary units are generally intended to operate indefinitely, although reenlistment, promotion, and casualties will alter the membership over time. Their work is physically demanding and conducted in real time, often in a hostile environment in the face of active resistance by civilian militia, or organized enemy units. A key feature of military team operation is their position in a "tall," hierarchical organization structure – their mission is to follow and execute orders. In theory, this organization is intended to allow small-unit military team activities to be relatively well structured [...].

[14] Salas, Sims et al. (2004) refer to teamwork as the interaction of a set of cognitions, behaviors, and attitudes and to KSAs being displayed. Since most researchers refer to KSAs in the context of teamwork, in this book that abbreviation will be used for knowledge (or cognitions), skills (or behaviors), and attitudes. KSAs are formed by learning processes that are enabled or constrained by someone's ability, personality, and other characteristics, such as values, interests, needs, goals, motives, and biological and demographical characteristics (Roe, 2002).

> At the same time, orders can be ambiguous or fulfilled in different ways, battles are chaotic, and plans break down quickly in combat; this leads to many ill-structured situations involving a continuous need for communication among team members and discretion on the part of unit commanders. Military teams as a whole tend to be fairly specialized in terms of unit activities, but within-team role specialization varies somewhat across branches [...]. All military units are highly dependent on specialized hardware in the form of vehicles, weapons systems, and specialized gear that allow them to operate in harsh conditions.

It should be noted that Devine's (2002) description of the military team, is what in military jargon would be labeled, 'a highly kinetic' picture of the military team, its tasks, and its environment. Devine's (2002) description emphasizes the peace enforcing type of tasks these teams may conduct. These tasks represent the 'warrior' (see e.g., Broesder, 2008) type of tasks for which Royal Netherlands Army military units are usually well trained (Gooren, 2006). In modern military operations, however, peace keeping, humanitarian, and stability and security assistance tasks occur as well. When performing such tasks, military teams may, for example, try to win 'the hearts and minds' of the local population (see e.g., Van der Meer, Van den Berg, & Bakker, 2007). In doing that, the teams 'smile and wave' towards the population when patrolling on foot, on bicycle, or mounted on a vehicle, with the aim to get in contact with the population, gather information, carry out the message that the troops are there to help, and not to fight, and to gain commitment among the population for the peace process. Likewise, military teams such as Provincial Reconstruction Teams (PRTs), have a main task in providing for local security and stability (e.g., by training the local police force or armed forces, installing a local government) and in reconstructing an area (e.g., [re]building essential infrastructure, such as hospitals, schools, and public facilities; see e.g., McNerney, 2005). So, nowadays, soldiers in military teams try to combine the role of being a warrior, as described by Devine (2002), with the role of being a peacekeeper, as described above (see e.g., Broesder, 2008).

Despite the caveat just mentioned on the description of the military team according to Devine (2002), several characteristics of the military team can be delineated from the description. The description reveals that the military team is a work team. Work teams produce, create, or do something that is meaningful to an organization (Gully, 2000). In that they distinguish themselves from teams or groups like families, sports teams, therapy or training groups. A characteristic of the work team is the lifetime of the team which is supposed to span many projects and is "typically open-ended" (Arrow et al., 2000, p. 84).[15] Because of this longer lifespan, there is a need for team members in work teams to invest time and effort in maintaining the team's integrity over time and to address team member's needs so the team member remains committed to the team and its purpose (Arrow et al, 2000; Devine, Clayton, Philips, Dunford, & Melner, 1999).

Following formation, military teams undergo an extensive training program and consequently will be deployed to a mission abroad. During the training period, the team composition remains fairly stable. When deployed, the team capitalizes on the experience gained in the training period. The team members work and live together intensely for months. Following the deployment, team members may leave the team for several reasons.

[15] Arrow et al. (2000) distinguish between several *work groups:* the task force, the crew and the team. A key characteristic which distinguishes between these three types of work groups is the stability of membership as expected by its members. Whereas membership is typically open ended for teams, it is not for task forces and crews.

First, because their employment is over. Other reasons may be that soldiers or corporals will attend the non-commissioned officers course or courses for other functions, or team members are transferred to other teams or units. New members will take the vacant places and team training starts again.

Devine's description of the military team closely resembles the typical action team (Sundstrom et al., 1990; Sundstrom, McIntyre, Halfhill, & Richards, 2000). The label action team is frequently used in the literature (e.g., Chen, Thomas, & Wallace, 2005; Kozlowski & Ilgen, 2006; Rasmussen & Jeppesen, 2006; Salas, Burke, & Cannon-Bowers, 2000) to denote teams that perform complex, time-limited events in demanding environments. The team members have specialized roles and they are highly interdependent. Moreover, action teams are highly integrated into their organizational context which implies that the team's performance is closely synchronized with other executive and support teams within the organization (Sundstrom et al., 1990).

Because of the complexity of tasks, the situations in which the team has to perform, the interdependence within teams and the integration of team performance with organizational units outside the team, action teams often require extended training and task preparation so team tasks can be completed successfully (Sundstrom et al., 1990). Within a typical infantry team, for example, each team member has a specific role, such as team leader, deputy team leader, driver of the Armored Personnel Carrier, gunner, rifleman, etc. Moreover, the team has a wide array of weapon systems and materiel, such as communication systems that can be used in task completion. The team members have to work closely together in order to protect each other's safety, but also to integrate each other's contributions.

Teams normally operate together with other teams. This cooperation needs close coordination and teams need to know each other's strengths and weaknesses so they can make optimal use of each other. For example, infantry teams may be supported by a reconnaissance team, a Gill anti-tank weapon system, a rifle for long distances, engineers, an electronic warfare team, a combat life saver, logistical units that supply the team with ammunition, fuel, food, etc. When resistance is fierce, teams may need backup from artillery teams. The teams request for artillery support, and communicate the coordinates of the targets and adjustments to the fire to the artillery team that may be stationed miles away. Backup may be provided by Apache helicopters or F16 fighter planes that fire at targets that are communicated to them by the Forward Air Controllers attached to the team. Medical evacuation helicopters may be called for when casualties have to be transported quickly to the hospital. It is clear that this working together within and outside the team is complicated, even more since military operations are conducted in an environment that has high situational uncertainty and high stress potential, and the stakes are high (Essens et al., 2009). This requires extensive training.

A key characteristic of action teams is the interdependence between team members (Gully, 2000; Ilgen, 1999; Kozlowski et al., 1999; Sundstrom et al., 2000). In general, two types of interdependence can be distinguished (Shea & Guzzo, 1987a, 1987b; Van der Vegt, Emans, Van de Vliert, 1998, 2001; Wageman, 1995). Task interdependence "is the degree to which [team] members must rely on one another to perform their tasks effectively given the design of their jobs" (Saavedra, Early, & Van Dyne, 1993, p. 61). Because of task interdependence, team members must coordinate, cooperate, and communicate with each other, and share resources, expertise, or information (Saavedra et al., 1993; Van der Vegt et al., 2001). Outcome interdependence is the "degree to which significant outcomes an individual receives

depend on the performance of others" (Wageman, 1995, p. 147). When team members are not outcome interdependent, they receive their rewards based on their individual performance. When team members are maximally outcome interdependent, they receive a reward exclusively based on team performance. According to Wageman (1995), goal achievement may be a significant outcome of team work. Team members in military teams are both highly task and outcome interdependent when performing their tasks.

Another aspect that emerges from Devine's description of the military team is that these teams have clear boundaries that differentiate one team from another. The military organization is a hierarchical organization; individuals are grouped into teams, several teams are grouped into a platoon, several platoons are grouped into a company, et cetera. Each unit, from the smallest team to the collection of all forces in a specific theatre of operations (e.g., International Security Assistance Force in Afghanistan) has a name or number and there can be no doubt who commands each unit. Being part of a specific team, platoon, or company provides the individual, team, or platoon with a kind of identity. Sometimes, symbols like flags, figures, animals, or names are used to underscore that specific identity (e.g., de *Koningscompagnie* [the King's company], de *Tijgercompanie* [the Tiger company]).

So, the military team in this study can be defined as a "collective of two or more individuals who exist to perform organizationally relevant tasks, share one or more common goals, interact socially, exhibit task interdependencies, maintain and manage boundaries, and are embedded in an organizational context that sets boundaries, constrains the team, and influences exchanges with other units in the broader entity" (Kozlowski & Bell, 2003, p. 334; Mathieu et al, 2008, p. 411). In addition, military teams have a past, present, and an expected future that affect its processes and the interaction among its members in the organizational context (Argote & McGrath, 1993; Gully, 2000; Ilgen et al., 2005; McGrath, 1984, 1991). Finally, military teams perform in demanding situations (Devine, 2002; Sundstrom et al., 2000).

2.3 Teamwork in context

2.3.1 Introduction to a general team effectiveness model

The literature presents a wide array of team effectiveness models that portray the way team members work together to accomplish work tasks. Most models are based on an Input – Process – Output (IPO) format that reflects the current state of the art within team research (Salas, Stagl, Burke, & Goodwin, 2007). In short, team inputs (e.g., team member's competencies, the team structure, tools, and procedures) enable or constrain team processes. These team processes are used by team members to perform individual tasks and to interact with each other so individual contributions are combined into a team output. Team outputs are the products of team performance.

Although the IPO model has dominated the literature in the past 40 years, more recently, this model has been criticized for several reasons. First, the factors that transform inputs into outputs are not mere processes (Ilgen et al., 2005; Marks, Mathieu, & Zaccaro; 2001; Rousseau et al., 2006), but also attitudes, values, cognitions, and motivations that are labeled emergent states (Ilgen et al., 2005; Mathieu et al., 2008). Second, Ilgen et al. (2005) argued that the IPO model has limited the research on team performance because it suggested a one-way-linear sequence from inputs, through processes, into outputs, thereby neglecting eventual feedback-loops whereby outputs on time 1 serve as inputs for the team on time 2 (Ilgen et al., 2005). Third, the IPO model suggests the sole existence of main effects from inputs on processes and from processes on outputs (Ilgen et al., 2005). Recent research has provided ample support for other effects, such as interactions between inputs and processes or emergent states, or interactions between processes or emergent states (Ilgen et al., 2005). Finally, the model pays no attention to the multilevel aspect of team performance in which team members are embedded in teams and teams are embedded in larger organizational contexts (Mathieu et al., 2008).

McGrath is said to be the 'founding father' of the IPO model (e.g., Kozlowski & Bell, 2003; Kozlowski & llgen, 2006; Mathieu et al., 2008). It is interesting to notice that McGrath, as one of the advocates of temporal and developmental issues in team research (e.g., Arrow et al., 2000; Harrison, Mohammed, McGrath, Florey, & Vanderstoep, 2003; McGrath, 1984, 1991; McGrath, Arrow, Gruensfeld, Hollingshead, & O'Connor, 1993; Tschan, 2008) submitted a model that does not give enough attention to these issues. In fact, McGrath did not submit such a model and most of the criticism regarding the IPO model he submitted is not warranted. In his 'Introduction to Social Psychology', McGrath (1964) submitted a rather complex model in which seven classes of variables (group composition, group structure, task and environment, group processes, group development, effects on members, and task performance) are related to each other in many ways, including multiple feedback loops. Moreover, according to McGrath (1964, p. 71), "[t]his way of looking at groups deals with group phenomena as a recurrent cycle of "input, process and output," in which the output, or results, at one point in time alters the input conditions for the next period of time, and these in turn alter subsequent group processes and results. [The model] outlines the stages in only one cycle of a continuous process." The processes, as McGrath defined them, are patterns of interactions among group members. These interaction processes can be regarded as the flow of meaning, the flow of influence, and the flow of affect. These three processes are closely interrelated and operate in interaction (McGrath, 1964). Finally, McGrath introduced three kinds of effects of group performance (task performance, changes to the group, and changes to group members) although researchers in this regard mostly refer to Hackman (1985; 1987; e.g., Chang & Bordia, 2001; Kozlowski & Ilgen, 2006) who described these criteria in more detail (McGrath [1991] himself, referred to Hackman [1985] as well). In sum, except for the multilevel aspects of team performance, McGrath's IPO model acknowledges the existence of complex interrelations between several constructs, among them processes and factors we now label as emergent states, and multiple feedback loops.

Although McGrath did not describe the IPO model as a static, linear model, most researchers nowadays assign those characteristics to the IPO model. The Input – Mediator – Outcome (IMO) model as proposed by Mathieu et al. (2008), however, explicitly incorporate the criticism on the IPO model and incorporates latest research findings. Therefore, Mathieu et al.'s (2008) model of team effectiveness (see Figure 1) will be used to place teamwork in the context of team performance, the antecedents of team performance, and its outcomes.

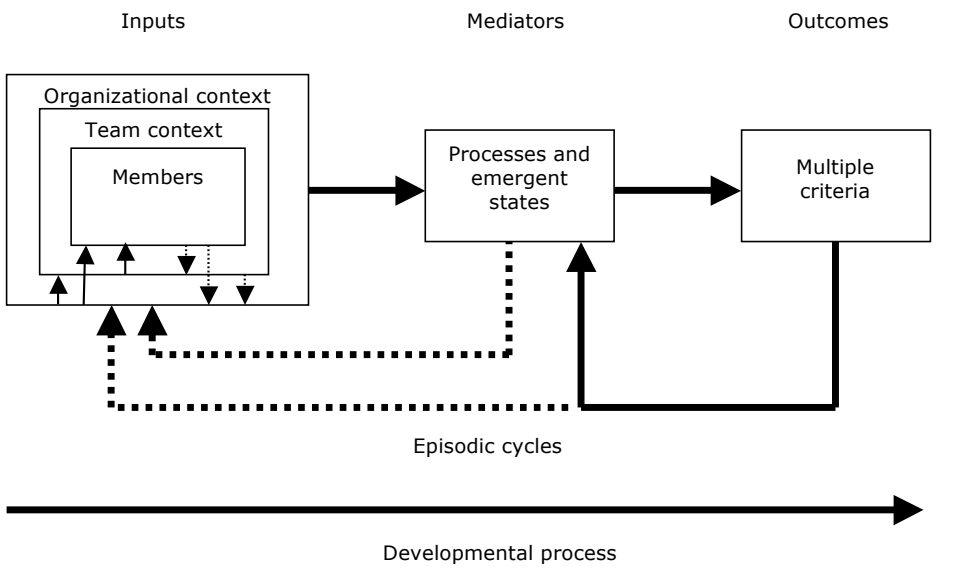

Figure 1: *The Input-Mediator-Outcome framework as proposed by Mathieu et al. (2008).*

2.3.2 *Team performance in episodic cycles*

Teams perform their tasks in *episodic cycles* (Mathieu et al., 2008). The episode can best be conceived of as a period in time in which a team is assigned a task, or assigns itself a task, and consequently engages in *taskwork* and *teamwork* activities that are necessary to accomplish the team task.[16] *Taskwork* are the individual team member's activities that do not require interdependent interaction with other team members (Salas et al., 2008). It is the team member's individual interaction with tasks, tools, machines, and systems (Bowers, Braun, & Morgan, 1997). *Teamwork* are the team members' "interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals. … [Teamwork] involves members interacting with other members and their task environment. [Teamwork is] the means by which members work interdependently to utilize various resources, such as expertise [and] equipment … to yield meaningful outcomes" (Marks et al., 2001, p. 357). In short, taskwork represents "what it is that teams are doing", whereas teamwork represents "how they are doing it with each other" (Marks et al., 2001, p. 357; Marks, Sabella, Burke, & Zaccaro, 2002), by directing, aligning, and monitoring taskwork. *Team performance* is the display of taskwork and teamwork by team members, and the display of integrated team-level action (Salas, Stagl, et al., 2007) in an episode (Marks et al., 2001; Mathieu et al., 2008). It is the aggregate of all team activities that are relevant for achieving team goals (Brodbeck, 1996).

[16] Marks et al. (2001) define an episode as a distinguishable period of time over which performance accrues and feedback is available. Episodes are marked by identifiable periods of action and transition processes between actions (Marks et al., 2001). In these latter periods, teams engage in activities such as mission analysis formulation and planning, goal specification, and strategy formulation (Marks et al., 2001). Marks et al. (2001) acknowledge that the episode's duration may be flexible (e.g., from hours to months), that episodes may overlap, and that episodes may be divided into sub episodes. This makes the concept of episode elusive. Nevertheless, in this book, the concept is useful in illustrating the difference between taskwork, teamwork, and team performance.

For example, a team may be ordered to execute a reconnaissance mission in concert with two other teams, into an area controlled by Opposing Militant Forces. The mission may take up several days. For each team, while executing this mission, several episodes can be distinguished and some of these episodes may overlap. First, the team prepares itself thoroughly for the mission. The mission will be analyzed and the map will be studied. Information will be gathered from, among others, the intelligence section of the battlegroup staff and factors influencing the mission will be assessed and evaluated. Consequently plans are made and coordinated with the other teams and higher echelons. The team members will be briefed by the team leader on what lies ahead, what the team is supposed to achieve and how the team will execute its mission, together with other teams. Another episode, that may start within the time frame of the former episode, is the team testing its weapons and other systems and materiel, gathering ammunition, fuel, food, water, spare parts and other needed resources and stowing them into their Armored Personnel Carrier (APC). The next episode may be the teams leaving the Forward Operating Base and driving into the area controlled by Opposing Militant Forces. That episode may end at twilight when the teams sets up a basic camp at several miles distance from the Forward Operating Base, to take a rest, prepare and eat food, and stay the night. The next day a new episode may start, with the teams driving towards a small settlement of *qualas in the green zone.*[17] The episode may continue with two teams occupying an overwatch position on the high grounds nearby the qualas. Their task is to observe the surroundings and to backup the action of the third team with fire support. The third team is split up. The APC, manned with the driver, gunner, and deputy team leader remains at the overwatch position, whereas the team leader and the remaining team members dismount the vehicle and patrol on foot into the green zone towards the qualas in order to gather some information from the local population.

As a bystander, you can see all activities each team displays over time, in each episode. All those team activities in that episode constitute the team's performance. For example, when the team members do not accurately test and maintain their equipment, leading to a breakdown of the APC before the team was even able to leave the Forward Operating Base, one might say the team did not perform well in that episode. In addition, when taking a closer look, you may see individual team members executing their taskwork within each episode. Take, for example, the episode in which the team leaves its basic camp in the early morning and drives towards the qualas in the green zone. The driver cautiously crosses a small bridge, and, at the same time, looks out for improvised explosive devices. In the mean time, the team leader reads the map and decides what route to take to the overwatch, whereas the gunner and other team members trace the surroundings for Opposing Militant Forces. At noon, the team arrives safely at the overwatch position where that episode ends. The next day when the team is on its way to the Forward Operating Base, for example, you may see an example of teamwork, when that same team drives into an ambush and receives heavy gunfire by Opposing Militant Forces. The driver stops the APC. The gunner fires at the Opposing Militant Forces. Next, smoke grenades are fired by the team to obscure its activities and the driver drives back the APC, as fast as possible with the team leader directing the driver towards a safe place, out of reach for Opposing Militant Forces gunfire. Radio contact is made with other teams that may support the withdrawal of the team and with higher echelons to inform them that the team is in contact with Opposing Militant Forces.

[17] A quala is a typical Afghan house or farm made of clay. Most of the Afghan territory in Uruzgan is made up of sand, stones, and rocks. It looks rather 'grayish'. Several parts of the countryside, however, are predominantly covered with green vegetation such as trees and bushes, especially in the presence of water (e.g., because of a small river) and are therefore called *green zones.*

When at a safe place, most team members dismount the APC, and secure the area by taking in firing positions around the APC. The team checks the status of personnel and materiel. Again, an episode ends. Another episode starts with the team leader consulting with higher echelons and other team leaders what to do next. The situation is assessed, a new plan derived and consequently, the team leader informs the team that they will return to the Forward Operating Base, following an alternative route, avoiding the Opposing Militant Forces.

2.3.3 Input factors

Team performance is enabled or constrained by several conditions (Essens et al., 2009). These conditions represent factors that determine how effective the team can be, given the circumstances. The conditions are the demands posed on the team and the capabilities of the team and its members. Mathieu et al. (2008) clustered these conditions, or inputs as they labeled them, into individual team member inputs, team inputs, and organizational or environmental inputs.

Team members inputs

Team members inputs, for example, are the team member's personality, aptitude, and individual knowledge and skills (Essens et al., 2005, 2009). Exemplary military team member inputs are rank (e.g., soldier, sergeant, captain), branch (e.g., Army, Air Force), and service (e.g., infantry, artillery, logistics). These three characteristics determine what these members are trained for and to what organizational cultural background they belong. As a consequence these characteristics contribute to how team members think and behave. Another individual military team member characteristic is the number of previous deployments that a team member may have been engaged in, contributing to that team member's proficiency and experience.

Team inputs

Team inputs are, for example, team composition, team size, and team maturity (Essens et al., 2005, 2009). Another team input is the team task. The team task describes what has to be done by the team. The team task itself can have several characteristics, such as the physical, cognitive, and emotional workload, and the complexity of the task due to the difficulty, number, interdependence, and interference of sub tasks (Essens et al., 2009). Other team inputs are the division of labor among team members and norms of conduct within the team. Typical military team factors are the materiel with which the team is equipped, for example, an APC, weapon systems, communication systems, and the procedures how to use this materiel.

Organizational or environmental inputs

Examples of organizational inputs are the organizational culture (Soeters, 2000), the mission and objectives of the organization, and organizational support. Environmental inputs are, for example, support for the organization and its mission, and other organizations. A typical military organizational characteristic is military law that enforces military discipline. This law defines strict rules for appropriate conduct when on duty. Another military organizational characteristic are the Rules Of Engagement. These Rules Of Engagement are important procedures how to use force when confronted with Opposing Militant Forces (see Appendix A for an example of a handout with Rules Of Engagement for military personnel). Typical environmental characteristics for military teams are the weather and terrain conditions in which it has to operate since these conditions may heavily impact the possible courses of action a team may choose from. Other typical environmental characteristics for military teams are the Opposing Militant Forces, the local population, and other institutions, such as other armies or police forces. Military commanders at all levels are trained to analyze these key organizational and environmental factors that may enhance or constrain their actions and to plan their actions accordingly (see Appendix A for an example of a handout with key organizational and environmental factors that military commanders have to take into consideration when estimating the situation).

Inputs enabling or constraining each other

Input factors at the team member, team, and organizational and environmental level may also enable or constrain each other (Mathieu et al., 2008). In Figure 1, the small, solid lines pointing upwards indicate that higher organizational level aspects may enable or constrain lower level aspects (Mathieu et al., 2008). The small, dotted lines pointing downwards indicate that lower organizational level aspects may enable or constrain higher organizational level aspects albeit that this effect is less likely to occur than the reverse (Mathieu et al., 2008). Some examples of these enabling or constraining effects are summarized in Table 1.

Table 1

Examples of enabling or constraining effects between types of input

Effect from … on …	Examples
Organization/environment → team	The organization provides the team with tasks, materiel, logistical support, and procedures that together affect the team's possible courses of action. Weather and terrain conditions make several courses of action for the team less likely or impossible (e.g., operating at night without night vision goggles makes it difficult if not impossible to detect and locate the Opposing Militant Forces exactly).
Organization/environment → individual	Organizational culture affects the values individuals pursue. Military law and the reward structure enforces disciplined behavior by military personnel. Extreme cold or hot weather impairs human functioning in military operations.
Team → individual	Team norms describe how team members should behave in certain situations. The division of labor within the team determines what tasks individuals have to perform. The distribution of power within the team determines individual status within the team.
Individual → team	Individual's collective experiences and abilities to display taskwork and teamwork KSAs determine the maturity and prestige of the team as a whole.
Individual → organization / environment	Military personnel's awareness of the culture or religion of the host nation, affects the organization's options for conducting specific local population oriented activities.
Team → organization/environment	The presence or lack of certain team skills and drills (e.g., how to search a quala) influences the organization's options for conducting specific search operations.

2.3.4 *Mediators: Team processes and emergent states*

Inputs do not automatically lead to outcomes (see Figure 1). Taskwork and teamwork *processes* and *emergent states* are needed to transform inputs into outputs (Mathieu et al., 2008). Processes capture how team members interact and combine their individual resources, coordinating knowledge, skill, and effort directed toward task accomplishment (Kozlowski & Ilgen, 2006; Mathieu et al, 2008). "Repeated interactions among individuals that constitute processes tend to regularize, such that shared structures and emergent states crystallize and then serve to guide subsequent process interactions … [so] emergent states, and routinized behavior patterns are the echoes of repeated process interactions" (Kozlowski & Ilgen, 2006, p. 81).

Emergent states are cognitive, affective/motivational, or conative states of teams that are dynamic in nature and vary as a function of team inputs, processes, and outcomes (Kozlowski & Ilgen, 2006; Marks et al., 2001, Mathieu et al., 2008). Team processes can be cognitive, affective/motivational, or behavioral in nature (Kozlowski & Ilgen, 2006).

Taskwork

Taskwork is the team member's individual interaction with tasks, tools, machines, and systems (Bowers et al., 1997). Since work teams may differ considerably in the type of tasks they have to perform (e.g., Devine, 2002; McGrath, 1984; Sundstrom et al., 1990) and the tools, machines, and systems the team has at their disposal, taskwork may encompass a wide array of activities. Because taskwork is not the object of this study, it will not be elaborated in more detail.

Teamwork

Teamwork processes and emergent states are needed to direct, align, and control taskwork. As was mentioned in Chapter 1, many teamwork frameworks or models are proposed in the literature. Each framework or model presents a set of KSAs or other characteristics that team members have to display in support of one's teammates and the team's objectives. Table 2 summarizes but a few of these frameworks or models from the literature. It appears that there is no general consensus on what KSAs subsume teamwork and the number of KSA may differ significantly per framework or model. In section 2.4, teamwork will be described in detail.

Table 2

Examples of teamwork frameworks or models

Number of dimensions	Authors	KSAs
4	Campion, Medsker, & Higgs (1993)	Potency, Social support, Workload sharing, Communication / Cooperation
	Nieva, Fleishman, & Rieck (1985)	Elicitation and distribution of information, Team organization, Team adaptation, Team motivation
	Smith-Jentsch, Johnston, & Payne (1998); Smith-Jentsch, Zeisig, Acton, & McPherson (1998)	Information exchange, Communication, Supporting behavior, Team initiative / Leadership
5	Stevens & Campion (1994); Miller (2001)	Conflict resolution, Collaborative problem solving, Communication, Goal setting and performance management, Planning and task coordination
	Nadjiwon-Foster, Smithers, & Livingstone (2002)	Boundary Management, Cohesion, Performance norms, Communication, Potency
	Nijhuis et al. (2007)	Communication, Decision making, Team commitment, Organizing the team, Goal setting
6	Hoegl & Gemuenden (2001); Hoegl, Weinkauf, & Gemuenden (2004)	Communication, Coordination, Balance of member contributions, Mutual support, Effort, Cohesion
	Gladstein (1984)	Open communication, Supportiveness, Conflict, Discussion of strategy, Weighting individual inputs, Boundary management

(continued)

Table 2 (continued)
Examples of teamwork frameworks or models

Number of dimensions	Authors	KSAs
6	Tannenbaum, Salas, & Cannon-Bowers (1996)	Coordination, Communication, Conflict-resolution, Decision-making, Problem-solving, Boundary spanning
7	Morgan, Glickman, Woodward, Blaiwes, & Salas (1986)	Team spirit, Coordination, Cooperation, Communication, Giving suggestions, Adaptability, Accepting suggestions
	Dickinson & McIntyre (1997)	Communication, Feedback, Monitoring, Coordination, Team leadership, Backup behavior, Team orientation
	McIntyre & Salas (1995)	Performance monitoring, Feedback, Closed-loop communication, Backup behavior, Team self-awareness, Fostering within-team interdependence, Flexibility
8	Salas et al. (2005)	Leadership, Team orientation, Mutual performance monitoring, Backup behavior, Adaptability, Mutual trust, Shared mental models, Closed-loop communications
	Cannon-Bowers et al., (1995); Salas, et al. (2000)	Adaptability, Shared situational awareness, Performance monitoring and feedback, Leadership / Team management, Interpersonal relations, Co-ordination, Communication , Decision-making
10	Marks et al. (2001)	Mission analysis formulation and planning, Goal specification, Strategy formulation, Monitoring progress toward goal, Systems monitoring, Team monitoring and backup behavior, Coordination, Conflict management, Motivation and confidence building, Affect management
14	Rousseau et al., (2006)	Team mission analysis, Goal specification, Planning, Performance monitoring, Systems monitoring, Coordination, Cooperation, Information exchange, Backing up behaviors, Intra-team coaching, Collaborative problem solving, Team practice innovation, Psychological support, Integrative conflict management
30	Salas, Rosen, Burke, & Goodwin (2009)	Team / collective orientation, Team / collective efficacy, Psychological safety, Team learning orientation, Team cohesion, Mutual trust, Team empowerment, Team reward attitude, Team goal commitment / team consciousness, Mutual performance monitoring, Adaptability, Backup / supportive behavior, Implicit coordination strategies, Shared / distributed leadership, Mission analysis, Problem detection, Conflict resolution / management, Motivation of others, Intra-team feedback, Task-related assertiveness, Planning, Coordination, Team leadership, Problem solving, Closed-loop communication / information exchange, Rules for matching a situation with an appropriate action (cue-strategy associations), Accurate problem models, Accurate and shared mental models (transactive memory and team situational awareness), Team mission / objectives / norms / resources, Understanding of multi-team system couplings

2.3.5 *Outcomes of team performance*

"The sine qua non of … work [teams] is the successful completion of tasks, hence their effectiveness should turn on just that" (Shea & Guzzo, 1987a, 1987b, p. 330). Although it is true that work teams exist to produce, create, or do something that is meaningful to an organization (Gully, 2000), most researchers agree that besides team output, several other criteria should be used also to assess the team's effectiveness (e.g., Campion et al., 1993; Gladstein, 1984; Jordan, Feild, & Armenakis, 2002). In general, three criteria are used to determine the team's effectiveness (e.g., Arrow et al., 2001; Chang & Bordia, 2001; Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006; McGrath, 1991; Pescosolido, 2003). These criteria are the degree to which the *output* of the team meets or exceeds organizational standards of quantity or quality, the degree to which the capability of members to *work together* on subsequent team tasks is maintained or enhanced, and the degree to which *members' needs* are more satisfied than frustrated by the team experience (Hackman, 1985, 1987; Hackman & Oldham, 1980; Hackman & Walton, 1986).

Team output

The first effectiveness criterion is whether a team's output meets or exceeds organizational standards of quantity or quality. Just as there are many team types, types of team outputs vary as well depending on the team type and team task. This applies for military teams as well. Typical tasks for military teams that perform infantry-type actions in Peace Support Operations are manning observation posts, conducting site inspections, patrolling, securing or guarding locations, areas and convoys, and performing combat actions (Van Vliet et al., 2005).

For most of these military team tasks it is hard or nearly impossible to objectively determine whether the task output was effective (Villeneuve, Dobreva-Martinova, Little & Izzo, 2001). Nevertheless, even when such measures do exist, "what happens to a team usually depends far more on other's assessments of the output than it does on any objective performance measure" (Hackman, 1987; Hackman & Walton, 1986, p. 78). Therefore, Hackman and colleagues prefer to rely on the subjective assessment of the team's output by those who receive or review it (Hackman, 1985, 1987; Hackman & Oldham, 1980; Hackman & Walton, 1986).

Team viability

The second effectiveness criterion is whether the process of carrying out the work enhances the capability of team members to work together interdependently in the future. This criterion is referred to as team viability (e.g., Chang & Bordia, 2001; Mathieu et al., 2008) or team integrity (e.g., Arrow et al., 2000; Hackman, 1987). Working in teams can be cumbersome and it is possible that a team "burns itself up" in the process of task completion (Hackman, 1987, p. 323; Hackman & Oldham, 1980, p. 169). Even when the output was acceptable for those who received or reviewed it, if the team in the process of producing the output has made it nearly impossible to work together in the future, one can hardly argue the team has been fully effective (Hackman, 1987). Attaining and maintaining team viability, therefore, is both dependent and instrumental to the first effectiveness criterion (Arrow et al., 2000).

Again, there is no single criterion for team viability. Mathieu et al. (2008), for example, found several indicators in the literature, such as team membership stability over time, and intention to leave the team. Social cohesion can be regarded a strong indicator of team viability (Chang & Bordia, 2001). Social cohesion "refers to the nature and quality of the emotional bonds of friendship, liking caring, and closeness among group members. A group is socially cohesive to the extent that its members like each other, prefer to spend their social time together, enjoy each other's company, and feel emotionally close to one another" (MacCoun et al., 2006, p. 647). Socially cohesive groups perform better than less cohesive groups, especially when task interdependence is high (Beal, Cohen, Burke & McLendon, 2003).

Members' needs

The third effectiveness criterion is whether the team experience fulfills members' needs. Teams may develop patterns of interpersonal behavior that are destructive to the well-being of individual team members (Hackman & Oldham, 1980). Therefore, when most team members think their needs are more frustrated than satisfied with the team experience, the team can hardly be regarded as effective (Hackman & Oldham, 1980).

According to Mathieu et al. (2008), Janssen, Van de Vliert, and Veenstra (1999) adopted an interesting perspective on outcomes concerning member's needs by asking team members whether they were treated with respect. Respect concerns whether an individual feels accepted by and worthwhile for a group (De Cremer & Tyler, 2005). Feelings of being respected by group members positively influence an individual's self-esteem which in turn positively influences one's bonding with that group (Branscombe, Spears, Ellemers, & Doosje, 2002; Smith & Tyler, 1997).

The relativity of the three criteria for teams

Arrow et al. (2000) and Hackman and Walton (1986) argue that teams may differ in the relative priorities a team places on fulfilling the three effectiveness criteria over time. Depending on the circumstances, teams may alternate between satisfying task and socio-emotional needs (Arrow et al., 2000). For example, a military team that has been in heavy combat one day, may implicitly or explicitly 'decide' to take it easy on completing a team task the next day for the sake of the well-being of the team members.

2.3.6 Feedback loops and the team development process

Finally, Mathieu et al.'s (2008) model shows several *feedback loops*. The solid lines from outcomes to mediators indicate that this kind of feedback is "likely to be quite influential" (p. 414). The feedback loops from outcomes to inputs, and from mediators to inputs are represented by dashed lines which indicate that this feedback is "likely less potent" (p. 414) than feedback from outcomes to mediators. The feedback loops are labeled episodic cycles since feedback occurs as teams transition from one episode to the next, not within episodes (Mathieu et al., 2008). Table 3 presents several examples of feedback loops. Furthermore, teams mature over time (Mathieu et al., 2008). This is indicated by the line at the bottom of Figure 1, labeled developmental process. The development of the team will be elaborated in section 2.5.

Table 3

Examples of feedback loops

Effect from … on …	Examples
Outcome → processes	Having failed to complete a specific task successfully in an episode may lead a team to adjust the way team members work together on that task in the next episode.
Outcome → emergent states	Individual frustration or anger may be contagious and negatively influence the group's mood. Successful task completion may enhance the team's collective efficacy.
Outcome → inputs (team member)	Having completed a new team task, may lead to an increase in a team members' experience.
Outcome → inputs (team)	The team may alter its division of labor within the team based on experiences during task completion.
Outcome → inputs (organization /environment)	A specific successful action figured out by a team may become a standard operating procedure within the organization. A severe decline in individual mental and physical health due to earlier military operations may restrain the tempo in which the organization might want to execute subsequent operations.

2.3.7 *Summary: military teams and team performance*

Military teams are action teams that perform organizational relevant tasks in demanding situations. The military teams are embedded in an organizational context that, together with environmental factors enable or constrain the team's performance. This performance is also enabled or constrained by the characteristics of the individual team members and the team itself. Team tasks are completed by team members performing taskwork and teamwork activities. The result of the team's performance is the team's output. The team can be regarded effective if the output is as expected by (or exceeds) organizational standards. Since military teams work on many tasks, team members work together for longer periods of time, and consequently have a past and a future together. Therefore, besides producing an acceptable output, effective military teams enhance their members' ability to work together on future tasks and satisfy their members' needs.

2.4 Teamwork unraveled

In the center of the IMO model are processes and emergent states that mediate inputs into outcomes. Most researchers capture the essential processes and emergent states under the label teamwork. The following discussion on teamwork centers around a recent effort by Salas and colleagues (2005) who submitted a model of teamwork that encompasses the five most crucial KSAs that constitute teamwork. Following a short introduction, the model, which Salas et al. (2005) refer to as 'The Big Five in Teamwork' (BFT) will be outlined in detail by describing the constructs in the model and their proposed interrelationships. In addition, the model will be critically reviewed leading to several adjustments to the initial model and to alternative relations between variables in the model.

2.4.1 *Introduction to the Big Five in Teamwork*

Based on a review of more than 800 articles and chapters on team effectiveness published in the past 25 years, Salas, Stagl, et al. (2007) distilled 138 models that describe the relations between three or more constructs or construct categories. From these 138 models, Salas, Stagl, et al. (2007) selected eleven models that they typified as "cutting-edge team advancements" (p. 188). Among these eleven models is the BFT. Interestingly, Salas and colleagues are the co-authors of the articles in which four of these eleven models appeared. In addition, a fifth model appeared in a chapter of a book Salas and colleagues edited. Although Salas and colleagues were involved in five of the eleven cutting-edge advancements in team research, Salas, Stagl, et al. (2007, p. 199) stressed that it is not their intention to "covertly endorse a particular line of research." On the other hand, Mathieu et al. (2008, p. 411), who covered research from 1997 until 2007 that is "either representative of the work that has been done or because [it] provide[s] a vehicle for highlighting a novel finding or approach", did not mention the BFT.

Still, according to Salas, Stagl, et al. (2007), the BFT warrants its place among the eleven key advancements because it highlights the "essence of teamwork" by pointing at five critical KSAs and their interrelations that are the core of interdependent actions in teams (Salas, Stagl, et al., 2007, p. 211), whereas all other models, with some exceptions, treat teamwork as a sort of black box (Salas et al., 2005). The BFT is a parsimonious model that captures "the most explanatory power of teamwork behaviors over the broadest spectrum of contexts with the smallest number of explanatory mechanisms" (Salas et al., 2009, p. 47). In that it distinguishes itself from other models in which researchers have tried to present a comprehensive overview of the literature in their model aiming at inclusiveness rather than parsimony (Salas et al., 2009).

Salas et al. (2005) reviewed the theoretical models that appeared in the literature in the twenty years preceding their article. Of these models, Salas et al. (2005) used 24 models as primary and secondary sources for determining what specific processes lead to effective team functioning (see Table 4). Their rationale for using these 24 models was that these models provided insights on teamwork variables and their interrelatedness. The models were based on research with interdependent teams and the team members did not belong to extraordinary populations, nor were adolescents.

Table 4

Primary and secondary sources for the Big Five in Teamwork

Source	KSAs
Bandow (2001)	Mutual trust
Bandura (1991)	Team orientation
Brigg (1968)*	Backup behavior
Campion et al. (1993)	Adaptability, Team orientation
Cannon-Bowers et al. (1995)	Team leadership, Adaptability, Shared mental models
Driskell & Salas (1992)	Team orientation
Eby & Dobins (1997)	Team orientation
Hackman & Oldham (1980)	Team orientation
Hinsz, Tindale & Vollrath (1997)	Team leadership
Klein & Pierce (2001)	Adaptability
Klimoski & Mohammed (1994)	Shared mental models
Kozlowski et al. (1999)	Adaptability
Marks et al. (2001)	Team leadership, Backup behavior
Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers (2000)	Shared mental models
McIntyre & Salas (1995)	Mutual performance monitoring, Backup behavior, Closed-loop communication
Porter et al. (2003)	Backup behavior
Priest, Burke, Munim, & Salas (2002)	Adaptability

(continued)

Table 4 (continued)

Primary and secondary sources for the Big Five in Teamwork

Source	KSAs
Salas, Stagl, Burke, & Goodwin (in press)*	Team leadership
Shamir (1990)	Team orientation
Stewart & Manz (1995)	Team leadership
Stout, Cannon-Bowers, Salas, & Milanovitch (1999)	Shared mental models
Wagner (1995)	Team orientation
Webber (2002)	Mutual trust
Zaccaro, Rittman, & Marks (2001)	Team leadership, Shared mental models

Note. ** See comments regarding these publications in Appendix B.*

Salas et al. (2005) used several criteria for determining whether a specific variable should be included in their model. First, the variable should have the ability to be developed by interventions. This criterion supports one of the starting points of the model which states that the BFT should be "practically relevant" (Salas et al., 2005, p. 588). Second, they selected variables most commonly discussed in the literature that in addition have the greatest impact on team performance. This criterion supports another starting point of the model which states that the BFT should be "empirically supported" (Salas et al., 2005, p. 588).

The variables that were mentioned most frequently were leadership, supporting behavior, and flexibility (Salas et al., 2005). Based on these findings, Salas et al. (2005) decided to assign *team leadership, team orientation, mutual performance monitoring, backup behavior, and adaptability* as the core – or Big Five – of teamwork.[18] They added, however, that three coordinating mechanisms are needed to "meld together the value of each of the five factors" in the model (Salas et al., 2005, p. 559). These mechanisms are *mutual trust, shared mental models, and closed-loop communication*. Although the model is named the BFT, Salas, Stagl, et al. (2007) argued that the three additional KSAs together with the five core KSAs, *collectively* form teamwork (emphasis added). In the next section, the BFT will be outlined in detail.

[18] Although Salas and colleagues mention it nowhere explicitly, it is obvious that the label 'Big Five' refers to the often cited and used Big Five personality model, which includes the dimensions Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience (Costa & McCrea, 1985). See also chapter 1. It is interesting to notice that personality research nowadays has moved beyond the Big Five, and focuses on the search for two dimensions (Plasticity and Stability) or one dimension (General Factor of Personality, or high versus low on the Big Five dimensions) underlying the Big Five (e.g., Musek, 2007). This trend may be started in teamwork research by LePine, Piccolo, Jackson, Mathieu, and Saul (2008) who revealed that several narrowly focused teamwork processes load on three underlying teamwork domains, which in their turn load on one general teamwork factor. Based on Fishbein and Ajzen's (1974) compatibility principle, they argue that such a general teamwork factor is more appropriate in predicting general criterion constructs than the first-order teamwork constructs. The latter are more appropriate in predicting "fine-grained interpersonal activities" (LePine et al., 2008, p.294).

2.4.2 *A description of the Big Five in Teamwork*

For teams to be effective, team members have to cooperate and coordinate interactively with each other in order to optimally utilize the team's resources, such as member's task skills and knowledge, and machines, tools, and systems, and to orchestrate taskwork. In short, teamwork is needed to facilitate team effectiveness. As mentioned, according to Salas and colleagues (2005) five critical teamwork KSAs and three additional teamwork KSAs must be displayed by team members for teams to be effective. Table 5 presents the definitions as proposed by Salas et al. (2005) for each teamwork KSA. In addition to the definitions, Salas and colleagues provided for *behavioral markers* which are descriptions of behaviors that are typical for each KSA (see Table 5). Figure 2 pictures the eight KSAs and their interrelatedness to each other and to team effectiveness. The remainder of this section draws heavily on the original descriptions of the eight teamwork constructs and their interrelations by Salas and colleagues (2005).

Team leadership

The team leader has three overarching functions. First, the team leader is responsible for team members to have an accurate shared understanding of the team's objectives and the way the team will perform to attain those goals, including team members' roles. Moreover, it is the team leader who is often in the best position to monitor the team's constraints and resources. Therefore, it is the team leader who is responsible for disseminating the necessary information on these topics throughout the team. The second function of the team leader is to monitor the internal and external environment of the team. In that, the team leader checks whether the team progresses to goal attainment as intended. The team leader uses the information on internal and external changes to facilitate intra-team coordination and interaction and adaption. Third, the team leader establishes behavioral and performance expectations within the team. The team leader is responsible for making clear how the team has to perform. In addition to that, the team leader is expected to provide for clear task-based and team-based norms of acceptable behaviors within the team. The team leader is also responsible for creating a team climate that facilitates teamwork. Finally, the team leader tracks the deficiencies in KSAs of each team member and uses skill development opportunities when needed to enhance the team's ability to adapt to a wide variety of circumstances. Ultimately, team leaders influence team effectiveness indirectly by synchronizing and combining individual team member's contributions and by ensuring team members that they are interdependent and therefore benefit when they work together. Based on these team leadership functions, Salas and colleagues propose that team leadership affects mutual performance monitoring and backup behavior.

Team orientation

Team orientation is a general preference to work in team settings and "a tendency to enhance individual performance through the coordination, evaluation, and utilization of task inputs from other members while performing group tasks" (p. 584). Team orientation facilitates team performance because it increases task involvement and information sharing resulting in increased cooperation and coordination with other team members. Team orientation also enhances the willingness to accept directions and assistance from other team members. Therefore, Salas and colleagues propose that team orientation affects team effectiveness through team member's willingness to engage in mutual performance monitoring. They also propose that team orientation affects team effectiveness through team member's acceptance of directions and/or assistance through backup behavior.

Mutual performance monitoring

Mutual performance monitoring is defined as "the ability to keep track of fellow team members' work while carrying out their own to ensure that everything is running as expected and to ensure that they are following procedures correctly" (p. 575; see also Table 5 for another definition provided by Salas and colleagues). Mutual performance monitoring is the means by which team members gain team awareness. Mutual performance monitoring is especially important in stressful circumstances since team members under these circumstances are more likely to make mistakes. Based on the information gathered through monitoring each other's performance, and team performance in general, team members are able to provide each other with support. Therefore, it is proposed by Salas and colleagues that mutual performance monitoring affects team effectiveness through effective backup behavior. Mutual trust is an important prerequisite for mutual performance monitoring. Without trust, team members may regard mutual performance monitoring as spying on each other. To prevent team members reacting critically and negatively towards each other, monitoring each other should be an accepted norm. Therefore, Salas and colleagues propose that effective mutual performance monitoring will only occur in teams with a climate of trust. For mutual performance monitoring to be effective, team members have to have a shared understanding of the team tasks and the individual team member tasks. It is important that team members know from each other what the other is supposed to be doing. So, Salas and colleagues proposed that effective mutual performance monitoring will only occur in teams with adequate shared mental models.

Backup behavior

Besides the definition in Table 5, backup behavior is also defined by Salas and colleagues (p. 579) as "the discretionary provision of resources and task-related effort to another when there is recognition by potential backup providers that there is a workload distribution problem in their team". Team members can backup each other by providing each other feedback or coaching, by assisting each other, and by completing someone's task. If team members detect a workload problem, shifting workload to members who are underutilized prevents a degrading in team performance. For backup behavior to be effective, the need to provide backup must be legitimate and providing backup behavior may not be at the cost of other important tasks not being completed. This leads Salas and colleagues to propose that backup behavior affects team effectiveness directly by ensuring that all aspects of the team task are completed. In addition, Salas and colleagues propose that effective backup behavior requires the existence of adequate shared mental models and mutual performance monitoring. This knowledge structure and skill are necessary because they determine when a team member must backup, who should backup, and what backup must be provided for.

Adaptability

Adaptability is "the ability to recognize deviations from expected action and readjust actions accordingly" (p. 582). Teams have to have the ability to identify cues that internal or external conditions have changed. In addition, teams have to have the ability to assign meaning to that change and as a consequence must have the ability to develop and carry out a new action. These abilities are captured in adaptability. So, it is proposed by Salas and colleagues that the adaptability of a team has a direct effect on team effectiveness because adaptability ensures that team performance stays focused on goal attainment despite drawbacks in the environment. They also propose that shared mental models, mutual performance monitoring, and backup behavior are prerequisites for adaptability. Shared mental models ensure that team members have an understanding what goals are to be attained, what roles each team member has to perform and how changes within and outside the team affect the team's performance. Mutual performance monitoring ensures that teams observe deviations within the team that require internal adjustments or reallocations of work or resources or a complete new plan for the team. Backup behavior ensures that internal adjustments or reallocations of work or resources take place and thereby add to the team's ability to adjust.

Mutual trust

Besides the definition of trust in Table 5, Salas and colleagues provided another definition of trust as "the shared perception that individuals in the team will perform particular actions important to its members and will recognize and protect the rights and interests of all the team members engaged in their joint endeavor" (p. 568-569). Trust must prevent team members being busy in defending their own interests and checking and inspecting each other. The latter can be conceived of as the negative side of mutual performance monitoring. When team members trust each other, they are more willing to disseminate information more freely among each other. In addition, trust in teams is needed since being interdependent means that team members must be willing to accept a certain amount of risk to rely on each other. In a climate of trust, team members acknowledge that their team mates look out for each other and for the good of the team. Another aspect mentioned by Salas and colleagues is the importance of trust in the team leader. Trust in team leadership enhances the acceptance of the team leader's actions.

Shared mental models

Shared mental models are team-related and task-related knowledge structures that are shared among team members. The team-related knowledge structure contains information on aspects such as what the team should strive for, how the team should function, and how team members should behave in certain situations. The task-related knowledge structure contains information such as task procedures or procedures for using tools and equipment. Shared mental models enable team members anticipating and predicting each other's needs through a common understanding of the environment and performance expectations.

Closed-loop communication

Information within teams is exchanged by communication. Information is needed to update team member's shared mental models. Information is also needed for team members to engage in teamwork activities, such as backup behavior or adaptability. Therefore, communication within teams is invaluable. Even more important is the way team members communicate with each other. Several reasons may impair communication within teams, such as noise, misinterpretation, or lack of attention due to stressful circumstances. Closed-loop communication is a method of communication within teams that ensures that information is received and understood. It involves in the sender initiating the message, the receiver receiving it, interpreting it, and acknowledging its receipt, and the sender following to ensure the intended message was received.

Table 5

Definitions and behavioral markers of the teamwork constructs

Variable	Definition	Behavioral markers
Team leadership	The ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team knowledge, skills, and abilities, motivate team members, plan and organize, and establish a positive atmosphere.	Facilitate team problem solving. Provide performance expectations and acceptable interaction patterns. Synchronize and combine individual team member contributions. Seek and evaluate information that affects team functioning. Clarify team member roles. Engage in preparatory meetings and feedback sessions with the team.
Team orientation	The propensity to take other's behavior into account during group interaction and the belief in the importance of team goals over individual members' goals.	Taking into account alternative solutions provided by teammates and appraising that input to determine what is most correct. Increased task involvement, information sharing, strategizing, and participatory goal setting.
Mutual performance monitoring	The ability to develop common understandings of the team environment and apply appropriate task strategies to accurately monitor team mate performance.	Identifying mistakes and lapses in other team members' actions. Providing feedback regarding team member actions to facilitate self-correction.
Backup behavior	The ability to anticipate other team members' needs through accurate knowledge about their responsibilities. This includes the ability to shift workload among members to achieve balance during high periods of workload or pressure.	Recognition by potential backup providers that there is a workload distribution problem in their team. Shifting of work responsibilities to underutilized team members. Completion of the whole task or parts of tasks by other team members.

(continued)

Table 5 (continued)

Definitions and behavioral markers of the teamwork constructs

Variable	Definition	Behavioral markers
Adaptability	The ability to adjust strategies based on information gathered from the environment through the use of backup behavior and reallocation of intra team resources. Altering a course of action or team repertoire in response to changing conditions (internal or external).	Identify cues that a change has occurred, assign meaning to that change, and develop a new plan to deal with the changes. Identify opportunities for improvement and innovation for habitual or routine practices. Remain vigilant to changes in the internal and external environment of the team.
Mutual trust	The shared belief that the team members will perform their roles and protect the interests of their teammates.	Information sharing. Willingness to admit mistakes and accept feedback.
Shared mental models	An organizing knowledge structure of the relationships among the task the team is engaged in and how the team members will interact.	Anticipating and predicting each other's needs. Identify changes in the team, task, or teammates and implicitly adjusting strategies as needed.
Closed-loop communication	The exchange of information between a sender and a receiver irrespective of the medium.	Following up with team members to ensure message was received. Acknowledging that a message was received. Clarifying with the sender of the message that the message received is the same as the intended message.

Note. *Definitions and behavioral markers derived from Salas et al. (2005), p. 560-561. It should be noted that Salas and colleagues, provided alternative definitions for some of the teamwork constructs in their article. These alternative definitions are mentioned in this section. However, the definitions of Salas and colleagues, as mentioned in this table, will be used throughout this book.*

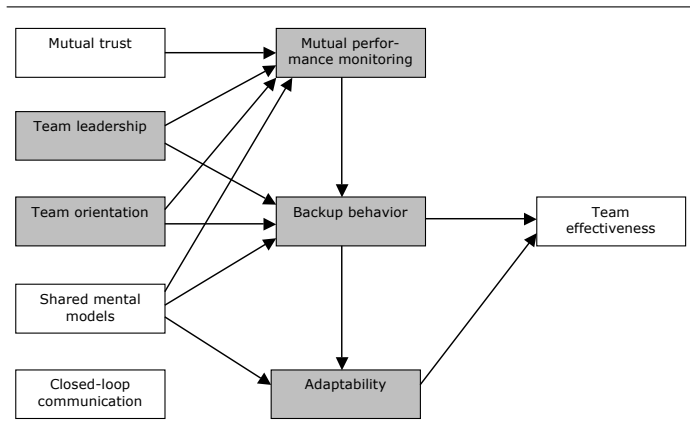

Figure 2: *Teamwork and its influence on team effectiveness. The relations between the teamwork KSAs and between the teamwork KSAs and team effectiveness are as pictured by Salas et al. (2005, p. 571). The Big Five KSAs are grey-shaded.*

2.4.3 Some critical remarks regarding the Big Five in Teamwork

Several critical remarks can be made regarding the relationships between the variables in the model. There are at least four reasons that warrant a critical examination of these relationships. First, the empirical support for the relationships in the model, based on the 24 primary and secondary sources, is modest. Moreover, it is unclear what other 118 models were reviewed since the article does not provide an overview of the models covered by the literature review. Second, in their article, Salas and colleagues (2005) suggest several relations between the variables in the model that are not incorporated in the model. Third, Salas and colleagues (2007) submitted an alternative BFT in which the relationships between the variables in the model differ significantly from the original BFT. Fourth, the model is unclear about the effects from closed-loop communication to other variables.

Empirical support for the model as provided by Salas and colleagues

Salas and colleagues selected 24 models as a primary or secondary source for the BFT. Appendix B presents these sources and briefly describes the contents of the articles or chapters. Of these 24 sources, eight sources describe the results of empirical studies whereas most sources present a review of the literature on the topic under investigation. Of these eight empirical studies, Campion et al.'s (1993) study tested teamwork in a field setting. The studies by Driskell and Salas (1992), Eby and Dobins (1997), Johnston and Briggs (1968), Mathieu et al. (2000), Porter et al. (2003), Stout et al. (1999), and Wagner (1995) were laboratory studies, most of them using ad-hoc teams with assigned tasks. Curiously, the studies by Hackman and Oldham (1980) and Shamir (1990) merely implicitly addressed the topic Salas and colleagues pointed at, whereas the studies by Bandura (1991) and Hinsz et al. (1997) did not address the topic at all. Finally, the study by Kozlowski et al. (1999) addressed the topic (i.e., adaptability), but it described how teams should be developed into adaptive teams; the study did not provide theoretical or empirical proof that adaptive teams are more effective.

Of the eight empirical studies, two studies provided support for the effect of backup behavior on team effectiveness (see Johnston & Briggs, 1968; Porter et al., 2003). One study provided support for the effect of shared mental models on team processes (i.e., anticipating team member's information needs; see Stout et al., 1999). Support for the effect of team orientation on backup behavior was provided by Eby and Dobins (1997) and Wagner (1995). The study by Campion et al. (1993) provided support for the effect of adaptability on team effectiveness.

Suggested relations

In their article, Salas and colleagues (2005) suggested six relations among teamwork KSAs that are not incorporated in their model. First, "the team leader has a role in the creation, maintenance, and accu-racy of the team's shared mental model" (p. 573). Second, "the team leader facilitates team effectiveness by monitoring the internal and external environment of the team to facilitate team adaptability" (p. 573). Third, "team leaders … facilitate team effectiveness … by insuring individuals on the team understand their interdependence and the benefits of working together" (p. 574; i.e., team orientation). Fourth, "trust is … needed in the acceptance of team leadership behaviors" (p. 569). Fifth, "[w]ithout this team climate [of trust], team members may … react critically to feedback or assistance provided by a team member" (p. 577; i.e., backup behavior). Finally, "effective adaptability requires … effective engagement in mutual performance monitoring" (p. 583). Salas et al. (2005) provided no information why these relations are omitted from their model.

A rudimentary BFT

The BFT appeared again in a book chapter written by Salas, Stagl, et al. (2007). This more recent BFT seems to be a rather rudimentary model as compared to the initial model that appeared in 2005. The rudimentary model lacks team effectiveness as a construct and therefore the effects from backup behavior and adaptability to team effectiveness. In addition, seven other effects were dropped and two effects were added that were not present in the initial BFT (mutual performance monitoring affects adaptability, and team leadership affects team orientation). Although both added effects were suggested in the original article, the authors, unfortunately, did not provide theoretical or empirical evidence for the changes from the initial BFT to the rudimentary model.

Closed-loop communication

In the model proposed by Salas et al. (2005), closed-loop communication is not explicitly related to one of the other KSAs. Serfaty, Entin, and Johnston (1995) distinguished two types of coordination mechanisms that teams use in order to adapt their actions. A shared mental model is an implicit coordination mechanism supporting adaptation, whereas specific communications are explicit coordination mechanisms supporting adaptation (Serfaty et al., 1995; see also Ellis, Bell, Ployhart, Hollenbeck & Ilgen, 2005). Teams generally alternate between exercising implicit and explicit coordination mechanisms depending on the workload: coordination strategies are dominated by explicit coordination under low workload conditions and by implicit coordination as workload increases (Serfaty et al., 1995). Based on the insight that teams alternate between explicit and implicit coordinating mechanisms, teams may alternate between the use of shared mental models and communications in order to adapt their actions and therefore, closed-loop communication, like shared mental models, has an effect on mutual performance monitoring, backup behavior, and adaptability.

2.4.4 Additional review of the literature

Hence, the authors of the BFT provided little empirical evidence for the relationships between the teamwork KSAs and between the KSAs and team effectiveness. Moreover, the authors suggested several relationships that were not incorporated in their original model and developed an alternative model that differed significantly from the original BFT. Therefore, an additional review of the literature may provide more insight on the relations among the teamwork KSAs and between the teamwork KSAs and team effectiveness.

Team leadership

Based on their review of the literature on leadership capacity in teams, Day, Gronn, and Salas (2004, p. 864) argued that an effective team leader will "create a climate that encourages mutual performance monitoring, supportive behavior, and adaptability … [and] shape the development of shared mental models in their teams … by interpreting and communicating key information to the team". Finally, they suggested that team leaders can shape or develop team orientation within the team. The latter two functions (i.e., promoting shared mental models and team orientation) together with promoting mutual performance monitoring, mutual error detection, resource sharing, and load balancing were regarded by Kozlowski, Gully, Salas, and Cannon-Bowers (1996) as important leader behaviors that shape team coherence which is a prerequisite for a team to anticipate, adapt and coordinate as one. Besides leadership functions being performed by one single individual, several authors suggested that leadership functions can be collectively enacted (e.g., Bligh, Pearce, & Kohles, 2006; Burke et al., 2006;

Day et al, 2004; Gronn, 1999, 2002) or that effective team processes can take over several leadership functions (e.g., Zaccaro & Klimoski, 2002). Sivasubramaniam, Murry, Aviolo, and Jung (2002, p. 68) took the former perspective when they studied the effects of team leadership – which they defined as "the collective influence of members in a team on each other" – on group performance. In their study (154 university students randomly assigned to 41 teams that completed a series of group assignments throughout a semester), Sivasubramaniam et al (2002) distinguished between transformational (i.e., inspirational motivation, intellectual stimulation, and individual consideration) and transactional (i.e., monitoring each other, directing attention toward failure) leadership behaviors. Both collectively enacted leadership behaviors affected team potency, that in turn affected team effectiveness. However, the effect for transformational behaviors was higher than for transactional behaviors (Sivasubramaniam et al., 2002). Noteworthy, Sivasubramaniam et al. (2002, p. 70) refered to teams high on transactional behaviors as a "collection of inspectors".

Hiller, Day, and Vance (2006, p. 390) reached similar conclusions on collectively enacted leadership as described above, based on their field study of 52 "traditional work teams" ($N = 277$). Teams that enacted more collective leadership behaviors (i.e., planning and organizing, problem solving, support and consideration, and development of others and mentoring) were rated as more effective by their supervisors than teams that enacted less collective leadership behaviors. In addition, the more team members favored team goals and needs over individual goals and needs (i.e., team orientation), the more these teams enacted leadership behaviors collectively.

Finally, Salas et al. (2005) mentioned 'engaging in preparatory meetings with the team' as an exemplary behavior of team leaders. Several studies provided empirical evidence for such meetings to positively influence shared mental models (e.g., Marks, Zaccaro, & Mathieu, 2000; Stout et al., 1999).

Team orientation

Jackson, Colquitt, Wesson, and Zapata-Phelan (2006) studied the effect of psychological collectivism on team performance. Psychological collectivism subsumes five facets, which are *preference* for working in groups rather than working alone, *reliance* on group members, concern for the well-being of the group and the needs of the group members, *norm acceptance* (i.e., acceptance of norms, rules, and procedures), and *goal priority* (i.e., valuing group goals over individual goals). Participants in their study were 128 full-time employees of a software firm and their supervisors. The employees filled out a questionnaire measuring psychological collectivism, whereas the supervisors filled out a questionnaire measuring four dimensions of job performance. The study provided empirical support for psychological collectivism positively affecting citizenship behaviors, which they regard as the core of teamwork, and negatively affecting counterproductive behaviors and withdrawal behaviors.

Mutual performance monitoring

Monitoring the team's functioning has long been regarded a typical team leader activity (Marks & Panzer, 2004). In teams, however, this function may be delegated by the team leader to other team members (Marks & Panzer, 2004), leading to team monitoring. This team monitoring is the mutual observation of activities and performance by team members (Dickinson & McIntyre, 1997; Marks & Panzer, 2004). Team monitoring leads to enhanced team awareness and as a consequence, team members are more able to adjust to each other's actions and detect mistakes or inadequate team performance (Marks & Panzer, 2004). Although team monitoring is regarded beneficial for almost all work teams, Marks and Panzer (2004) argue that team monitoring is critical for action teams. Action teams are highly interdependent and team performance requires superior communication and synchronization to accomplish team goals, which both are facilitated by team monitoring (Marks & Panzer, 2004).

Based on their study (using 32 three-person teams of university students, 'flying' PC-based helicopter simulation missions), Marks and Panzer (2004) conclude that team monitoring positively influences the quality of coordination within teams. By monitoring each other's actions, team members are better able to evaluate other team members' pacing of task activities and consequently are able to timely adjust their actions to that pacing and so remain "in sync" with each other (Marks & Panzer, 2004, p. 37). Moreover, team monitoring also affects intra-team feedback, and the provision of backup behavior within teams. Team monitoring increases the likelihood that mistakes or omissions are detected on time, before they can jeopardize team performance. In that, team monitoring may contribute to enhanced team safety, especially in challenging and dangerous environments (Marks & Panzer, 2004).

Contrary to these findings, Webber (2008) found that monitoring and citizenship behaviors, such as helping each other and displaying consideration for each other, were negatively correlated. Moreover, monitoring negatively affected cognitive trust (i.e., beliefs about peer reliability and dependability, and peer competence). Monitoring did not affect affective trust (i.e., interpersonal care and concern, and emotional bonds). It should be noticed, however, that Webber, in her study (78 teams preparing a written assignment and a presentation; $N = 294$ university students) used items that were rather negatively formulated and implicitly assumed lack of effort, proficiency or intent by other team members (i.e., "I have sometimes found it necessary to work around team members to get things done the way that I would like them done", "I keep a close track of my interactions with team members, keeping track of instances when they do keep track of their end of the bargain", "The quality of work I receive from members of this team is only maintained by my diligent monitoring of members", and "Rather than just depending on some team members to come through, I try to have a backup plan ready"). This operationalization of monitoring may account for the negative relationship between monitoring and citizenship behaviors.

Backup behavior

Backup was defined by Marks et al. (2002, p. 6) as "assisting team members in performing their tasks. Assistance may occur (a) by providing a teammate with verbal feedback or coaching, (b) by behaviorally assisting a teammate in carrying out actions, or (c) by assuming and completing a task for a teammate". For backup behavior to occur, team members must have an understanding of each other's roles (Porter et al., 2003). Furthermore, team members must be able and willing to provide or seek help when needed (Porter et al., 2003).

When task demands increase for a team member, the need for help may also increase. Helping behavior by other team members is facilitated when high-quality relations exist between helper and help-seeker (Anderson & Williams, 1996). Helping behavior is also expected when the team member in need for help, actively seeks for help (Anderson & Williams, 1996). However, seeking for help is negatively influenced when the team member in need for help thinks that asking for help is embarrassing, may cause indebtedness to others, causes loss of freedom when accepting help, or is

a threat to his or her self-esteem (Anderson & Williams, 1996). Asking for help is also negatively influenced when the possible helper has no or limited job autonomy. This lack of autonomy may limit the helper's ability to provide help, whether it is as a volunteer or at request, because the possible helper is tied to his or hers own task demands (Anderson & Williams, 1996). On the other hand, perceived task interdependence with the possible helper, positively influences the team member asking for help (Anderson & Williams, 1996).

Earlier studies provided empirical evidence for the positive effect of helping behaviors in teams. For example, Podsakoff and MacKenzie (1997) reviewed four studies that revealed that helping behaviors enhanced group performance. More recent studies also provided empirical evidence for the positive effect of helping behaviors.

Studying 62 three-person groups of business students participating in a card-sequencing competition, Bachrach, Powell, Collins, and Richey (2006), concluded that for groups high on task interdependence, more helping behaviors led to more effective groups. For groups with low task interdependence, both groups low and high on helping behaviors were less effective than teams that displayed moderate levels of helping behaviors. Bachrach et al. (2006) provided as a possible explanation for this finding that in groups low on task interdependence, high levels of helping behaviors might have been performed at the cost of completing one's own tasks.

Ehrhart, Bliese, and Thomas (2006), studying 31 units or companies (N = 2403; participants filled out a questionnaire), concluded that helping behaviors correlated positively with several aspects of military unit preparedness (i.e., physical fitness and weapon proficiency) and awards, even when controlled for by cohesion, conflict, and leader effectiveness. Helping behaviors were not significantly correlated with combat readiness when controlled for the other three variables. According to the authors, a possible explanation for the latter finding is that cohesion and leader effectiveness are more proximal predictors of perceived readiness than helping behaviors.

Finally, Ng and Van Dyne (2005) regarded helping behavior, the altruism dimension of organizational citizenship behavior, the helping coworkers dimension of organizational spontaneity, and the helping-others dimension of contextual performance as conceptually similar concepts. In addition, helping may be in-role or extra-role behavior (Ng & van Dyne, 2005). In their study (815 business school students randomly assigned to 176 teams that performed a presentation and two written case analyses), Ng and Van Dyne (2005) found that teams with the greatest disparity in helping behaviors (i.e., some team members display large amounts of helping behavior and others very little) performed worse than did teams with less disparity, leading them to conclude that contributions of helping behaviors in teams should be more or less homogeneous.

Adaptability

Although Ilgen et al. (2005) referred to adaptability as workload sharing in the form of either helping behaviors or backing up behaviors, Salas and colleagues (2005) referred to adaptability as the ability to adjust strategies and altering a course of action or team repertoire in response to changing internal or external conditions. Chen et al. (2005) studied the effect of action processes on adaptive team performance. Chen et al.'s (2005) action processes were derived from Marks et al.'s (2001) framework of teamwork processes. These action processes are monitoring progress toward goals, system monitoring (i.e., internal and environmental factors), team monitoring and backup behaviors, and coordination (i.e., orchestrating the sequencing and timing of interdependent actions). Several of these action processes closely resembled adaptability as defined by Ilgen et al. (2005) or Salas et al. (2005). Based on their study of 78 dyadic teams of university students 'flying' helicopter missions on a computer-generated simulation program (team member behaviors were assessed by subject matter experts), Chen et al. (2005) concluded that action processes (i.e., one measure for the combination of the four processes) affected adaptive team performance.

Mutual trust

Trust is "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another … or [the] belief that one can rely upon another person's actions and words, and/or that the person has good intentions" (Dirks & Ferrin, 2001, p. 451). Based on a meta-analysis of 119 studies, Colquitt, Scott, and LePine (2007) found evidence for a positive effect of trust on cooperative and prosocial behavior. Dirks and Ferrin (2001) reached a similar conclusion, based on a review of over forty studies.

Shared mental models

Lim and Klein (2006) distinguished between *taskwork mental models* that describe the content and structure of team members' mental models of the equipment and procedures that are used by the team, and *teamwork mental models* that describe the content and structure of team members' mental models of team interaction processes within the team. They defined mental models as "organized knowledge frameworks that allow individuals to describe, explain, and predict behavior [by] … specify[ing] relevant knowledge content as well as the relationships between knowledge components" (Lim & Klein, 2006, p. 404). Lim and Klein (2006) also distinguished between the accuracy and the similarity of the shared mental models. The former relates to the quality of the model relative to some standard, mostly a single 'ideal' or 'expert' model (Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). The latter refers to the extent to which team members' mental models are consistent with each other (Mathieu et al., 2005).

Smith-Jentsch, Cannon-Bowers, Tannenbaum, and Salas (2008) studied 25 intact submarine attack-center teams (N = 385; team size ranged from 7 to 21). The data were collected during a pre-deployment training over a period of two years. In the first year, 15 teams took part in the study (the control condition), and the remaining 10 teams took part in the second year (the experimental condition). The teams participated in two briefing-exercise-debriefing training cycles. The exercise took place in a submarine attack center simulator and lasted 3 hours. In the control condition, teamwork was addressed in a general way during the briefs and debriefs. In the experimental condition, an expert model of teamwork was used as a guide for improving teamwork in a structured manner during briefs and debriefs. The study revealed that in the experimental condition, the average teamwork mental model *accuracy* was greater. The study failed to provide evidence that the average teamwork mental model *similarity* was greater.

Based on their field study on 71 combat teams (each team consisted of eight or nine soldiers) that performed several small unit operations, such as overcoming a small enemy force, Lim and Klein (2006) concluded that teamwork mental model similarity affected team efficiency (i.e., taking time to get things done). Moreover, teams whose average taskwork mental models were most accurate (i.e.,

similar to experts' taskwork mental models) were more efficient than teams whose average taskwork mental models were less accurate.

Mathieu et al. (2005) conducted a study, using 70 two-person teams (university students performing PC-based flight simulator missions). Their study revealed that shared taskwork mental models affected team processes (i.e., leadership, assertiveness, decision making/mission analysis, adaptability/ flexibility, situation awareness, and communication). On the other hand, shared teamwork mental models did not affect team processes. However, if both team members possessed high-quality yet different teamwork mental models (interaction effect), they had the most difficulty executing effective team processes and these teams were less effective (Mathieu et al., 2005). This occurs when each team member is sure on what needs to be done, yet they disagree with each other (Mathieu et al., 2005).

Marks et al. (2002) conducted a laboratory study using 45 three-person teams (university students 'flying' PC-based helicopter flight simulation missions). Based on their study, Marks et al. (2002) concluded that shared teamwork mental models affected team coordination (i.e., the process of orchestrating the sequence and timing of interdependent actions by exchanging information and mutual adjustment of actions) and backup behavior within the teams. In addition, team coordination and backup behavior affected the team's effectiveness.

2.4.5 Summary: an adjusted Big Five in Teamwork and alternatives for the relations among variables in the Big Five in Teamwork

In addition to the primary and secondary sources that Salas et al. (2005) used to support the BFT, other empirical and theoretical studies were reviewed. Most empirical studies concerned laboratory studies in which students were randomly assigned to two- or three-person teams performing computer simulated tasks.

Figure 3 presents an overview of the empirical and theoretical support for the relations among teamwork KSAs and between teamwork KSAs and team effectiveness as proposed by Salas et al. (2005), for the effect of closed-loop communication on teamwork variables, and for the six relations among teamwork KSAs that were suggested by Salas et al. (2005). The numbers along the paths in Figure 3 refer to the empirical and theoretical support of that path (see Figure's note for an explanation of the meaning of each number).

The twelve relations that were incorporated in the initial BFT (see also Figure 2) are presented by solid lines in Figure 3. For all relations in the model, additional support to the support based on the 24 primary and secondary sources could be found, except for the relation shared mental models → mutual performance monitoring. For that relation, only Stout et al.'s (1999) study, as one of the 24 primary or secondary sources, provided support.

The three dashed lines in Figure 3 represent the effects of closed-loop communication on teamwork KSAs. Although no additional literature to the primary and secondary sources could be found that studied the effect of closed-loop communication in teams, it is suggested that the effects of closed-loop communication as an explicit coordinating mechanism are like the effects of the implicit coordinating mechanism shared mental models. So, closed-loop communication may affect mutual performance monitoring, backup behavior, and adaptability.

Finally, the six dotted lines in Figure 3 represent the effects of the relations among teamwork KSAs that were suggested by Salas et al (2005) but not incorporated in their model. For all suggested relations, additional support could be found.

The model as proposed by Salas et al. (2005), with closed-loop communication affecting the teamwork KSAs that are affected by shared mental models, will be labeled the adjusted BFT. In addition, Figure 3 presents several promising alternative relations between the teamwork KSAs and between teamwork KSAs and team effectiveness.

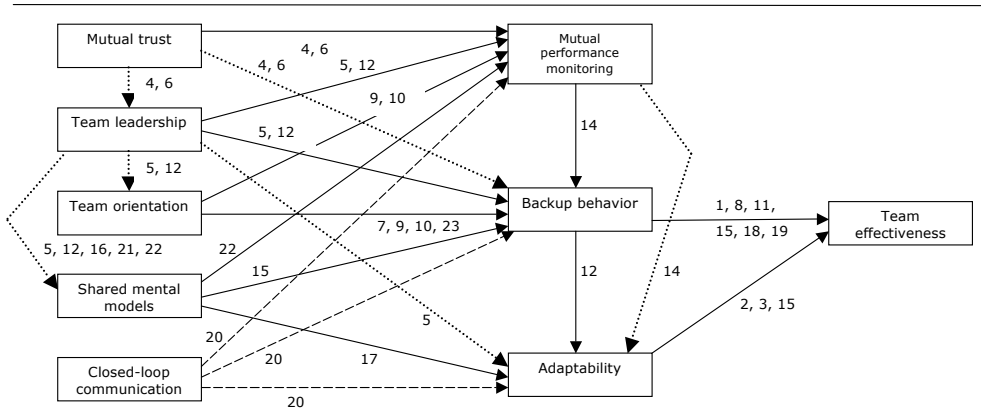

Figure 3: *Empirical and theoretical support for relations among teamwork variables and between teamwork and team effectiveness. Solid lines represent effects as proposed by Salas et al. (2005); dashed lines represent effects for closed-loop communication; dotted lines represent effects as implicitly suggested by Salas et al. (2005). Numbers refer to studies that provide empirical or theoretical support for proposed effect: 1 = Bachrach et al., 2006; 2 = Campion et al., 1993; 3 = Chen et al., 2005; 4 = Colquitt et al., 2007; 5 = Day et al., 2004; 6 = Dirks & Ferrin, 2001; 7 = Eby & Dobbins, 1997; 8 = Ehrhart et al., 2006; 9 = Hiller et al., 2006; 10 = Jackson et al., 2006; 11 = Johnston & Briggs, 1968; 12 = Kozlowski et al., 1996; 13 = Lim & Klein, 2006; 14 = Marks & Panzer, 2004; 15 = Marks et al., 2002; 16 = Marks et al., 2000; 17 = Mathieu et al., 2005; 18 = Podsakoff & MacKenzie, 1997; 19 = Porter et al., 2003; 20 = Serfaty et al., 1998; 21 = Smith-Jentsch et al., 2008; 22 = Stout et al., 1999; 23 = Wagner, 1995.*

2.5 Development in teamwork

2.5.1 Development in teams in general

Effective teams do not start "full-blown and mature" from scratch (Kozlowski et al., 1999, p. 248). It normally takes time for teams to develop and become effective. Like teams in general, Salas and colleagues (McIntyre & Salas, 1995; Salas et al., 2005) expected teamwork to gradually and incrementally improve over time as well, through experience, practice and training.

The development of teams has received ample research attention, resulting in more than hundred theoretical models (Chang et al., 2006). According to path dependent theories, group development is a rather linear process in which groups gradually and incrementally progress through predefined stages towards an optimal end state (Chang et al., 2006; Kozlowski et al., 1999; McCollom, 1995; Morgan,

et al., 2001). The stages in these path dependent models are more or less distinguishable clusters of behaviors that most groups display, or are occupied with, at particular moments in the life span of the group (Chang et al., 2006; McCollom, 1995). A well know example of such a path dependent model is Tuckman's (1965) forming-storming-norming-performing developmental sequence in groups. The process of team development is generally regarded as an informal process by which team members attempt to create effective social structures and work processes on their own (Kozlowski & Ilgen, 2006).

Besides the more or less informal team development process, other more formal processes, such as training and team building, may instill or bolster the team's ability to perform effectively. For example, the purpose of training military teams is to enhance the *skills and drills* for the individual soldiers and the teams in order to be able to perform effectively and coordinated under operational circumstances. Training, thus, "serves to automate controlled behavioral processes" (Paris et al., 2000, p. 1064) that enable effective team performance. In addition, team building activities (e.g., goal setting, improving interpersonal relations, improving problem solving, and role clarification) are interventions aimed at enhancing team performance and effectiveness (Klein et al., 2009).

Arrow and colleagues (Arrow, 1997; Arrow et al., 2000) refer to the end state of the development process as a *robust equilibrium* or an *habitual routine* (Arrow et al, 2000). According to Gersick and Hackman (1990, p. 69), "[an] habitual routine exists when a group repeatedly exhibits a functionally similar pattern of behavior in a given stimulus situation without explicitly selecting it over alternative ways of behaving". Habitual routines enable team members to predict actions of other team members so concerted and coordinated action between team members is possible (Gersick & Hackman, 1990). McGrath (1991, p. 159), in this context, referred to a "satisficing" or "least effort" default path that teams use when addressing the three team functions (i.e., team production, team viability, or team member's well-being). The skills and drills, mentioned earlier, can be regarded as habitual routines or default actions that are instilled in the military teams by training.

2.5.2 *Factors influencing the sustainability or deterioration of teamwork*

Path dependent models are useful in providing a comprehensive picture of the developmental process in teams in general (Chang et al., 2006). Such models, however, do not provide insights on the team's development due to its interaction with its embedding context (Chang et al., 2006). Contrary to path dependent theories of development, McGrath's (1991) theory of Time, Interaction, and Performance (TIP) of groups, predicts that major shifts in the default patterns of group activities concerning the three functions of the group are to be expected when the group experiences changes in group membership, task type and task difficulty, and operating conditions. Gersick and Hackman (1990) also referred to the operating conditions as important factors that may lead teams to change their habitual routines. In addition, Guzzo and Dickson (1996, p. 334) pointed at the "power of the context" in affecting team performance. Similarly, Morgan et al. (2001) regarded environmental demands and constraints as important determinants of drawbacks in team development, leading to teams revising their taskwork and teamwork processes.

Unfortunately, McGrath (1991, p. 170) concluded that very little empirical evidence is available to support his theory since remarkably little research has been done on that topic. More recently, Kozlowski and colleagues echoed a similar conclusion when arguing that little is known on how teams can sustain effective levels of performance over time (Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006) and that this topic is "a ripe target for systematic and rigorous research" (Kozlowski & Ilgen, 2006, p. 107). The few research findings available (e.g., Katz, 1982) suggest that team performance deteriorates over time (Kozlowski & Bell, 2003).

To make things more complicated, many variables may affect the team's development and performance over time (Argote & McGrath, 1993). They therefore argued, that field studies should include as many relevant variables as possible. Since field studies lack the possibility to randomly assign cases and experimental manipulations and controls, failure to measure crucial variables in a field study may not only limit what can be learned from the study, but it can also lead to learning misleading results. The latter can be due to "[inferring] relations between variables that are the spurious result of underlying – but unmeasured – variables" (Argote & McGrath, 1993, p. 376).

In fact, since team effectiveness models start where development models end (Kozlowski & Bell, 2003), many organizational or environmental, team level, or individual team member factors may influence teamwork (see the IMO model; Figure 1). Likewise, team processes and emergent states may affect teamwork as well.

Five factors will be described below, that may be of influence on teamwork development. These factors are the emergent state *potency,* the process of *inter-team cooperation*, the emergent states of *vertical cohesion* and *satisfaction with job characteristics*, and the input factor *working in high risk circumstances*. Besides the empirical or theoretical evidence that is available in the literature on the effect of these factors on teamwork development, potency, vertical cohesion, and satisfaction with job characteristics are incorporated in the Netherlands Armed Forces' morale research. These factors have already proven to be of influence on team performance in military settings (Van Boxmeer, Duel, De Bruin, & Verwijs, 2008; Van Boxmeer, Verwijs, & De Bruin, 2007; Van Boxmeer, Verwijs, De Bruin, Duel, et al., 2007, 2008).

Before introducing the factors, it should be noted that potency and inter-team cooperation, or similar concepts, are incorporated in several teamwork frameworks (see e.g., Table 2). That is, several researchers regard these factors as part of teamwork. However, in this study, potency and inter-team cooperation are not regarded to subsume teamwork but they may be closely intertwined with teamwork as is pictured in the IMO framework which was described in section 2.3 (see Figure 1).

Potency

Potency is defined as the collective belief of team members that the team can be effective (Kennedy, Loughry, Klammer, & Beyerlein, 2009; Lester, Meglino, & Korsgaard, 2002; Shea & Guzzo, 1987a, 1987b; Sundstrom et al., 2000). Potency closely resembles team efficacy which also addresses the team's belief in its capability. The difference, however, is that team efficacy refers to a team's belief it is capable performing a *specific task*, whereas potency is a generalized belief about team capabilities *across tasks and situations* (Gully, Incalcaterra, Joshi, & Beaubien, 2002; Mathieu et al., 2008).

Potency appears to be a robust predictor of team performance across several types of teams in varied settings (Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006; Mathieu et al., 2008; Sundstrom et al., 2000). Moreover, it is expected to contribute to teams sustaining in effective performance, even under challenging circumstances (Houghton et al., 2003; Shea & Guzzo, 1987a, 1987b) since it affects the extent to which team members apply their resources and effort to the team's task (Mathieu et al., 2008;

Shea & Guzzo, 1987b). The more team members sense their team being potent, the more willing they are to establish high levels of task-driven interaction (Shea & Guzzo, 1987b).

An important question is whether potency affects performance, or performance affects potency. Shea and Guzzo (1987a, 1987b) supported the former idea. DeShon, Kozlowski, Schmidt, Milner and Wiechmann (2004) also posited that efficacy beliefs at the team level precede team actions. Although based on team, or collective efficacy (i.e., a team's belief it is capable performing a specific task), Tasa, Taggar, and Seijts (2007) found that "individuals are more likely to be motivated to engage in teamwork behaviors when they find themselves in efficacious groups". Likewise, Jung and Sosik (2003), Lester et al. (2002), and Pearce, Gallagher, and Ensley (2002) argued that potency affects team processes. However, these researchers also think that performance in turn affects potency.[19] Gully et al. (2002), based on their meta-analysis, concluded that their study was not able to identify the causal relation between potency and performance. Nevertheless, Gully et al. (2002, p. 828) thought that potency causes performance since "it is difficult to believe that teams will engage in an activity if they feel it is impossible for members to accomplish anything". On the other hand, Gully et al. (2002) argued that performance is also likely to affect subsequent potency. Finally, Kennedy et al. (2009) found empirical evidence that organizational support affects team processes, which in turn affect potency, which consequently affects team effectiveness.

Military teams usually operate under demanding circumstances (see e.g., Bartone, 2006). For example, military teams may operate in unknown environments with danger lurking because of possible attacks by Opposing Militant Forces or improvised explosive devices. Moreover, civilians may not be distinguishable from Opposing Militant Forces so teams have to be extremely alert for possible danger. Teams may be confronted with a local population that may use unfamiliar languages and that have a different culture. Sometimes, working conditions may be harsh due to extreme climates or terrain conditions. Because of these demanding circumstances, potency is an important emergent state in military teams to be able to sustain in effective teamwork over time.

Inter-team cooperation

Another important contextual factor enabling or constraining team performance is what Sundstrom et al. (2000) referred to as *external group processes*. These external group processes are the interactions of team members with leaders in the organization (see Guzzo & Dickson, 1996). Other external group processes are interactions, such as external integration, coordination, and communication among team members and other teams (Sundstrom et al., 2000). Kennedy et al. (2009), in this context, referred to the integration of the team with other parts of the organization. Teams may become isolated and lose touch with other teams and leaders which may result in teams being unable to work toward effective work solutions (Kennedy et al., 2009). In an earlier study, Katz (1982) indeed found that the communication between teams deteriorates over time resulting in a deterioration of performance. A possible explanation is that over time, team members establish "certain stable structures of interlocked behaviors and relationships simply because it keeps them feeling secure and confident in what they do ... [and] gradually become less receptive toward communications that threaten to disrupt significantly their comfortable and predictable work practices and patterns of behavior" (Katz, 1982, p. 84). So, this behavior stability (Katz, 1982), or habitual routines or default paths within teams, diminishes the willingness or felt need within teams for communication with people outside the team.

In section 2.2, the military team was defined. One characteristic of the military team was that these teams are embedded in a larger organization and that they need to closely cooperate, coordinate, and communicate with other teams to be successful. Most military operations are conducted with teams of teams (e.g., a platoon). That is, the execution of tasks with several teams in concerted action. Teams that are used to be closely connected with other teams while executing tasks, are also more used to perform under dynamic circumstances, and to adapt to each other and the situation.
As a consequence, teams must adapt internally as well. Moreover, teams that are used to exchange experiences and lessons learned on a regular basis, are more inclined to improve their processes to boost performance. So, teams that are high on inter-team cooperation are more inclined to sustain or improve in teamwork over time than teams that are low on inter-team cooperation. The latter may become isolated and as a consequence may become unreceptive to signs that teamwork deteriorates and needs improvement (Katz, 1982).

Vertical cohesion

As was mentioned above, the interaction of team members with leaders in the organization, is an important contextual factor. Bliese and Halverson (1996) referred to this interaction as vertical cohesion which they defined as subordinates' perceptions that leaders are considerate and competent. This vertical cohesion can be distinguished from team leadership as described earlier in that the former more refers to the social-related aspects of leadership and the latter more refers to the task-related aspects of leadership. Vertical cohesion can also be distinguished from horizontal cohesion which is basically similar to social cohesion (Dion, 2000) and that refers to fraternal bonding and kinship within a group (Bliese & Halverson, 1996). Team leaders and other proximal leaders influence the interpersonal climate in their immediate area. In that, leaders that are supportive, create a constructive climate leading to team members attending to each others' actions and responses (Cannon & Edmondson, 2001; Chen, Chang, & Hu, 2007; Walumbwa, Luthans, Avey & Oke, 2009).

Earlier studies revealed that military team members' confidence in military leaders depends on the leader's professional capabilities, the leader's credibility as a source of information, and the amount of care and attention that the leader pays to the soldiers (Gal, 1986). Later studies also revealed that high quality leadership, which is characterized by leaders being considerate and competent, provides soldiers with confidence and optimism about successfully accomplishing mission objectives (Britt et al., 2007; Chen & Bliese, 2002; Shamir, Zakay, Breinin, & Popper, 1998).

Since military teams are part of a strongly hierarchical organization (see section 2.2), leaders play an important role in the military. Their role becomes even more prominent since military teams are to operate in, what Kolditz (2006, 2007) refers to as 'in extremis settings'. These settings are characterized by life-and-death situations. Military leaders may be tasked or forced by circumstances to take their teams into these settings. Vertical cohesion, like 'in extremis leadership' (Kolditz, 2007), is needed in such circumstances to work effectively as a team. This vertical cohesion captures the team member's sense that their leader is competent, is caring for them, is committed to the team, is honest, is connected to the team members, that he shares information, and that he has a strong sense of duty (Kolditz, 2007).

[19] Tasa et al. (2007, p.24) also found evidence for "groups high in collective efficacy [using] high-quality group processes, perform well, and yield increasing collective efficacy and performance over time". See also Lindsley, Brass, and Thomas (1995) who theorized on efficacy-performance spirals.

Satisfaction with job characteristics
At the individual level, it is expected that satisfaction with several aspects of the job contribute to the effort that an individual brings to bear on the team task (Hackman & Oldham, 1980). These aspects are whether the task requires a variety of skills, whether the task is meaningful and significant, whether the task provides the individual some autonomy, and whether the individual receives feedback from the work (Hackman & Oldham, 1980). Individuals that experience their work as being meaningful, who feel responsible for their work, and who have knowledge of the results of their work are more motivated to work with more effort on their tasks. For a team as a whole, it is expected that aspects of the group task affect the level of effort the team brings to bear on the team task (Hackman & Oldham, 1980). Indeed, there is empirical evidence that at the team level, satisfaction with job characteristics affects helping behaviors in teams (Jex & Thomas, 2003; Mason & Griffin, 2005; Yun, Cox, Sims, 2007).

Teams are to be deployed for several months, and during that time the job is paramount. Team members are working almost 24/7 when being deployed. Besides, it was mentioned above, the job may be very difficult and challenging. So, the job takes a central place in the life of team members for months. Therefore, satisfaction with job characteristics is very important to keep the team members going and to have them putting effort in working together on that job (Yun et al., 2007).

High risk circumstances
It should not come as surprise by now, that military teams may be confronted with high risk circumstances. Peace Support Operations can pose some serious threats to military personnel, of which (suicide) attacks and getting wounded or killed may have the most impact (Kamphuis & Vogelaar, 2007). In fact, being killed or getting wounded, or the threat of it, is a very salient aspect of military missions (Van den Berg, 2009). Death or the threat of it "shows up in roadside warnings, in briefings, is made salient by protective equipment, and possibly by experience with victims of violence among opposing military forces, the civil population, or among one's own troops" (Van den Berg, 2009, p. 11).

In general, threat situations induce two processes at the team level which are restriction in information processing and constriction of control (Staw, Sandelands, & Dutton 1981). The former has also been referred to as a narrowing of attentional focus (Driskell, Salas, & Johnston, 1999). This attentional narrowing leads to team members becoming more self-focused at the cost of being team oriented (Driskell et al., 1999). With increasing external demands, team members' attention gets more attracted to central task cues, thereby neglecting to attend to other team members. As a consequence of deterioration in team orientation, team performance declined (Driskell et al., 1999). The second process was related to constriction of control. Indeed, with increasing uncertainties and risks, military leaders in Peace Support Operations are more inclined to take more control and are less inclined to delegate (Vogelaar, 2009). This especially applies when the safety of military personnel is at stake (Vogelaar, 2009). On the other hand, when confronted with threat, team members are more inclined to rely on the team leader's opinions and directions (Staw et al., 1981).

Together, restriction in information and constriction in control may lead to teams responding more rigidly. That is, teams tend toward applying well-learned or dominant responses (Staw et al., 1981). However, since team members may be less inclined to attend to other team members and to less prominent cues in the environment, team performance may be impaired (Kamphuis, 2010; see also Van den Berg, 2009).

2.5.3 Summary
Based on the findings described in section 2.5, it may be expected that teams develop over time. That is, team members establish social interaction patterns and improve in performing taskwork and teamwork processes. However, the development process is likely to culminate in a robust equilibrium, or a set of habitual routines. This stage of robust equilibrium is characterized by teams, more or less automatically, using a similar pattern of behaviors, given a certain situation at hand. The end state of a military training program may be that teams have developed a sound social structure and patterns of behaviors to effectively execute their tasks, to remain viable as teams, and to address member's needs.

Still, teams may change their habitual routines due to environmental demands and constraints. Although it is suggested that there may be a myriad of factors influencing teamwork development, little theoretical or empirical evidence is available. However, five factors have been identified that may be of importance for teamwork development, especially in military settings. These are potency, inter-team cooperation, vertical cohesion, satisfaction with job characteristics, and working in high risk circumstances. Lack of potency, low inter-team cooperation, low vertical cohesion, and low satisfaction with job characteristics may lead to a deterioration of teamwork over time. Likewise, working in high risk circumstances may impair teamwork over time.

3.

Research design and hypotheses

3. Research design and hypotheses

3.1 Introduction

Effective teamwork is a critical mission success factor for military teams. Therefore it is crucial that team members, and those who train and lead them have insight in the important KSAs that subsume teamwork, how these KSAs influence each other and how teamwork affects team effectiveness. Based on these insights, formal or informal interventions can be executed that are aimed at leveraging teamwork. Moreover, it is crucial to understand what factors affect teamwork over time in Peace Support Operations, so effective teamwork can be sustained under difficult circumstances by influencing those factors.

Unfortunately, the literature is unclear as to what KSAs subsume teamwork since a wide variety of frameworks and models of teamwork are presented in the literature. In addition, most frameworks and models lack empirical evidence and if empirical evidence is available, this is mostly gathered in a laboratory setting using ad-hoc teams composed of students performing assigned tasks. Finally, the literature is unclear about what factors influence the team's ability to sustain in effective teamwork over time.

Therefore, in Chapter 1, following the central research question **"What effect does teamwork in military teams have on team effectiveness and how do military teams sustain their teamwork over time?",** two research questions were formulated. These are:

1 **What KSAs subsume teamwork and how are these KSAs related to each other and to team effectiveness?**

2 **How does teamwork develop over time and what factors are of influence on that development?**

Based on the theory presented in Chapter 2, section 3.2 presents and outlines the research design of this study. Section 3.3 presents the hypotheses that are formulated to find an answer to the first research question. In addition, section 3.4. presents the hypotheses that are formulated to find an answer to the second research question.

3.2 Research design

Figure 4 presents a brief overview of the design of this study. The relations between the antecedents of teamwork KSAs and teamwork, among teamwork KSAs, and between teamwork KSAs and team effectiveness will be studied at two moments in time. The concepts and their relatedness that are captured within the dashed lines, will be used to find an answer to the first research question. This part of the study will be outlined in section 3.3. In that section, Figure 5 will present a detailed picture of the KSAs that are to subsume teamwork, how they affect each other, and how these KSAs affect team effectiveness. Also, the hypotheses that will be tested to find an answer to the first research question, will be introduced.

The concepts and their relatedness that are captured within the dotted lines in Figure 4, will be used to find an answer to the second research question. Since these concepts and their relatedness are studied

at two moments in time, it is possible to analyze their development. In section 3.4, this part of the study will be outlined. Figure 6 presents the antecedents of change in teamwork, and the hypotheses that are derived.

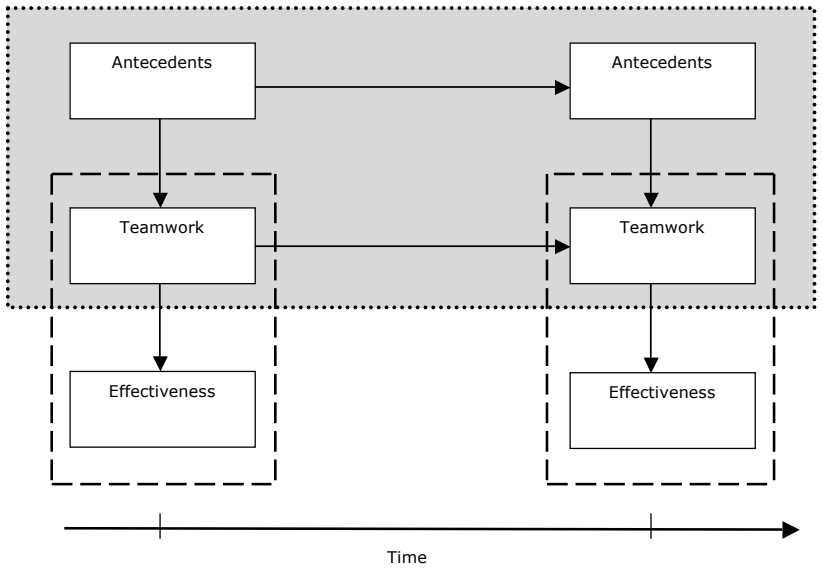

Figure 4: *Research design.*

3.3 Teamwork and its effect on team effectiveness

As described earlier, teamwork is a set of flexible KSAs that interact to achieve desired mutual goals and adaptation to changing internal and external environments. It consists of the KSAs that are displayed in support of one's teammates and the team's objectives. Researchers generally agree that teamwork affects team effectiveness. Team effectiveness is the degree indicating (1) whether the output of the team meets or exceeds organizational standards of quantity or quality, (2) whether the capability of members to work together on subsequent team tasks is maintained or enhanced, and (3) whether members' needs are more satisfied than frustrated by the team experience.

As has been shown in Chapters 1 and 2, although researchers generally agree that teamwork affects team effectiveness, little agreement exists among researchers what constitutes teamwork. Several KSAs are expected to affect team effectiveness, however, there is not one set of core KSAs that researchers agree on. As mentioned previously, a recent teamwork model, presented by Salas et al. (2005), tries to capture the essential KSAs that subsume teamwork. According to the model, the interplay of team leadership, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental models, and closed-loop communication affects the team's effectiveness (see Figure 5). Hypotheses 1 through 15 suggest relations among these variables, as proposed by Salas et al. (2005, p. 571), with three minor adjustments to that model. These minor adjustments concern the relationships from closed-loop communication to other variables in the model. Hypotheses 16 through 21 represent relations that are suggested by Salas et al. (2005) but were not incorporated in their model. Hypotheses 22 through 24 represent that team output, cohesion within the team and respect among team members are indicators of team effectiveness. These 24 hypotheses will be introduced below.

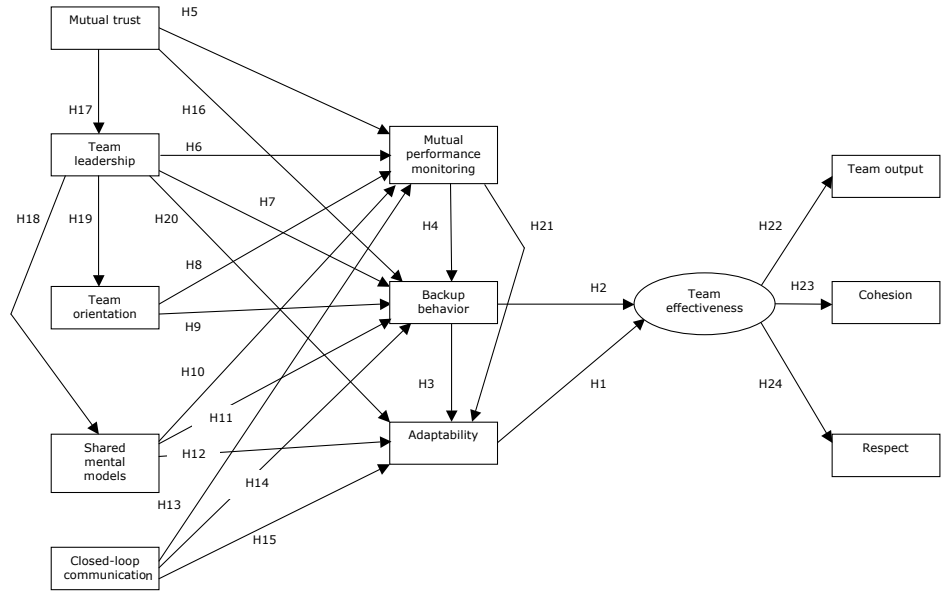

Figure 5: *Hypothesized model of teamwork and its effect on team effectiveness. H= hypothesis.*

Adaptability is the ability to adjust strategies and altering a course of action or team repertoire in response to changing internal or external conditions. Adaptability affects team effectiveness because adaptability ensures that team performance stays focused on goal attainment despite drawbacks in the environment.

Hypothesis 1: The adaptability of a team positively affects team effectiveness.

Backup behavior is assisting team members in performing their tasks. Assistance may occur by providing a teammate with verbal feedback or coaching, by behaviorally assisting a teammate in carrying out actions, or by assuming and completing a task for a teammate. Backup behavior affects team effectiveness directly by ensuring that all aspects of the team task are completed. In addition, backup behavior enables internal adjustments or reallocations of work or resources which add to the team's ability to adjust.

Hypothesis 2: Backup behavior positively affects team effectiveness.

Hypothesis 3: Backup behavior positively affects adaptability.

Mutual performance monitoring is the ability to keep track of fellow team members' work while carrying out their own to ensure that everything is running as expected and to ensure that they are following procedures correctly. By mutually monitoring each others' performances, team members gather information that enable team members to provide each other with feedback or help.

Hypothesis 4: Mutual performance monitoring positively affects backup behavior.

Mutual trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another or the belief that one can rely upon another person's actions and words, and/or that the person has good intentions. Mutual trust is an important prerequisite for mutual performance monitoring. Without trusting the good intentions of other team members, one might think negatively about being monitored, for example, monitoring is spying on each other, or a means of keeping tabs on each other. This may apply to both the amount of monitoring that takes place and the way monitoring is conducted.

Hypothesis 5: Mutual trust positively affects mutual performance monitoring.

Team leadership is the ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team knowledge, skills, and abilities, motivate team members, plan and organize, and establish a positive atmosphere. Although team leaders are expected to perform several functions, ultimately team leaders are effective to the degree that they ensure that all functions critical to task and team maintenance are completed. Team leaders do so by synchronizing and combining individual team member's contributions and by stimulating team members to monitor each other. In doing so, team leaders shape team coherence which is a prerequisite for a team to anticipate, adapt, and coordinate as one.

Hypothesis 6: Team leadership positively affects mutual performance monitoring.

Hypothesis 7: Team leadership positively affects backup behavior.

Team orientation is a general preference to work in team settings and a tendency to enhance individual performance through the coordination, evaluation, and utilization of task inputs from other members while performing group tasks. Team orientation increases task involvement and information sharing resulting in increased cooperation and coordination with other team members. Team orientation also enhances the willingness to accept feedback and assistance from other team members.

Hypothesis 8: Team orientation positively affects mutual performance monitoring.

Hypothesis 9: Team orientation positively affects backup behavior.

A shared mental model is an organized knowledge framework on team-related and task-related aspects that allows individuals to describe, explain, and predict behavior. Shared mental models enable team members to have a shared understanding what goals are to be attained, what roles each team member has to perform and how changes within and outside the team affect the team's performance. Since the shared mental model provides each team member with information on what other team members are supposed to be doing, this knowledge framework enables mutually monitoring each others' performances. Moreover, it allows team members to determine whether a team member needs backup, who should backup, and what backup must be provided for.

Hypothesis 10: Shared mental models positively affects mutual performance monitoring.

Hypothesis 11: Shared mental models positively affects backup behavior.

Hypothesis 12: Shared mental models positively affects adaptability.

Closed-loop communication is a way of communicating, which ensures that messages are received and interpreted as intended. Team members may coordinate each other's action implicitly by using shared mental models. Explicit coordination requires communication. So, when team members adjust to internal or external circumstances, or provide each other with help or feedback, team member may explicitly use communication. When using communication, closed-loop communication ensures that the message is received and acted on as intended.

Hypothesis 13: Closed-loop communication positively affects mutual performance monitoring.

Hypothesis 14: Closed-loop communication positively affects backup behavior.

Hypothesis 15: Closed-loop communication positively affects adaptability.

The review of the literature revealed several alternative relations among teamwork KSAS that were not incorporated in the model as proposed by Salas et al. (2005). These alternative relations are presented in Figure 3 (i.e., the dotted lines in the figure). Therefore, besides the hypotheses formulated above, the following hypotheses were formulated.

Mutual trust is an important prerequisite for backup behavior and team leadership. Team members have to trust each other in that each team member gives his full effort in completing team tasks. So, when there is a need for backup, the implicit or explicit request for help must be legitimate. In addition, team members have to trust the team leader for without trust in the good intentions of the team leader, his opinions and directions may be to no avail.

Hypothesis 16: Mutual trust positively affects backup behavior.

Hypothesis 17: Mutual trust positively affects team leadership.

Team leaders have an important task in providing team members with a shared understanding of how the team should execute its taskwork and teamwork. Besides providing team members with an initial shared mental model before task execution, team leaders have to update their team member's models while the team performs. In addition, team leaders should foster team member's awareness that they depend on each other to be effective as a team. Finally, the team leader has a key role in identifying cues that signal important changes in the team or the environment that may impair the team successfully accomplishing its mission, and, consequently, in developing new plans or actions to deal with those changes.

Hypothesis 18: Team leadership positively affects shared mental models.

Hypothesis 19: Team leadership positively affects team orientation.

Hypothesis 20: Team leadership positively affects adaptability.

For teams to be able to be adaptive, team members should engage in mutual performance monitoring so changes in internal conditions will be noticed.

Hypothesis 21: Mutual performance monitoring positively affects adaptability.

Finally, for teams to be effective, the team's output should meet or exceed the demands of those who review it. Next, effective teams have team members who get along well, and who have sound social bonds, that cultivate their ability to work together in the future. Besides, effective teams contribute to team member's sense of being accepted and worthwhile for the team. That is, in effective teams, team members feel respected by other team members.

Hypothesis 22: Team effectiveness positively affects team output.

Hypothesis 23: Team effectiveness positively affects cohesion among team members.

Hypothesis 24: Team effectiveness positively affects respect.

3.4 The antecedents of change in teamwork

For teams and other organizational parts that are trained and prepared for a specific situation, the experience of that situation itself may lead to changes in the teams and the other organizational parts which may consequently affect teamwork to change over time. The proof of the pudding, is in the eating, so to speak. The literature reveals little insights on what factors influence teamwork over time. Nevertheless, based on the literature the following hypotheses could be forwarded (see Figure 6).

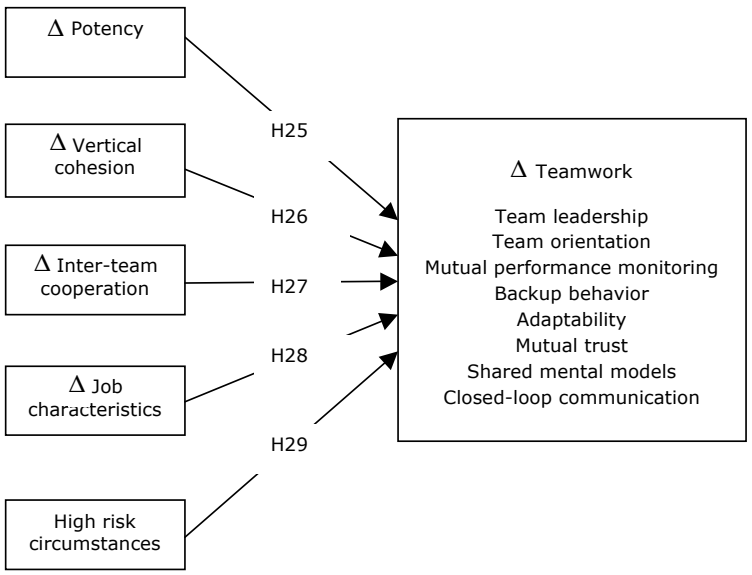

Figure 6: *Hypothesized model of antecedents of change in teamwork over time.*

Potency is the collective belief of team members that the team can be effective. Potency contributes to teams sustaining in effective performance, even under challenging circumstances by affecting the extent to which team members apply their resources and effort to the team's task. Teams high on potency establish high levels of task-driven interaction.

Hypothesis 25: Change in potency in teams over time is positively related to change in teamwork KSAs over time.

Vertical cohesion is an attitude of team members towards leaders in the organization. Vertical cohesion positively affects an interpersonal climate between leaders and their followers characterized by consideration. Such a climate affects team members to attend to each others' actions and responses. Vertical cohesion also positively affects trust between leader and follower, based on the experienced competence of leaders by team members.

Hypothesis 26: Change in vertical cohesion over time is positively related to change in teamwork KSAs over time.

Inter-team cooperation concerns the interactions between teams, such as external integration, coordination, and communication among team members of two or more teams. Teams must keep in touch with other teams and leaders outside the team to keep the team 'in sync' with other teams and to learn from other teams' experiences.

Hypothesis 27: Change in inter-team cooperation over time is positively related to change in teamwork KSAs over time.

Satisfaction with job characteristics is a positive attitude someone holds towards his or her job due to the degree the job provides meaning, a sense of responsibility, and knowledge of the results of the work. Team members high on satisfaction with job characteristics are more motivated to work with more effort on their tasks or assist others with their tasks.

Hypothesis 28: Change in satisfaction with job characteristics in teams over time is positively related to change in teamwork KSAs over time.

High risk circumstances pose threats to the team. Threat may result in restriction in information and constriction in control within the team. As a consequence, team members more rely on the team leader and are less responsive to other team member's needs.

Hypothesis 29: High risk circumstances positively affects team leadership while negatively affecting the remaining teamwork KSAs.

3.5 Summary

This chapter described *what* will be studied. Twenty-four hypotheses were formulated to find an answer to the question how teamwork KSAs are related to each other and to team effectiveness. This part of the study is more confirmative of nature since the literature provides several insights on how teamwork KSAs are expected to be related to each other and team effectiveness. The remaining five hypotheses were formulated to find an answer to the question what factors influence teamwork over time. This part of the study is more explorative in nature since the literature reveals little insights on what factors affect teamwork so it improves or deteriorates over time. The next chapter describes *how* the study was conducted.

4.
Research methods

4. Research methods

4.1 Introduction

This chapter describes the teams that participated in this study and the context in which they operated, the instruments that were used to collect data on teamwork within those teams and their effectiveness, and the procedure that was used to collect those data. Chapters 5 and 6 describe the analyses that were used to find an answer to the research questions and the results of those analyses.

4.2 The population

This study was conducted among several military units of the Royal Netherlands Army that prepared for, and conducted Peace Support Operations in Afghanistan and Bosnia-Herzegovina. First, both missions will be introduced briefly. Consequently, characteristics of the military organization structure will be described. Following that, an overview of the population and the sample will be provided.

4.2.1 The missions in Afghanistan and Bosnia-Herzegovina

Afghanistan

The Netherlands have deployed military troops to Uruzgan, a southern province of Afghanistan, since March 2006 (see Figures 6 and 7).[20] The troops in Uruzgan have the task to contribute to a safe, stable, and democratic Afghanistan. They therefore support the Afghan Government in providing security for the people by training the police and Afghan army and by combating those elements that try to undermine the legal Afghan Government. Moreover, the troops contribute to the development of the province by executing several reconstruction projects, such as building schools and providing or repairing the necessary infrastructure. The troops that participated in this study operated under dangerous circumstances. Besides combat actions against forces that opposed the legal Afghan Government, the main threats against the troops were bomb attacks with improvised explosive devices and suicide attacks. Several of these attacks wounded or killed soldiers and civilians.

[20] Figure 7 was downloaded from http://www.defensie.nl/missies/afghanistan/ on August, 26, 2009. Figure 8 was downloaded from http://www.rtl.nl/components/actueel/rtlnieuws/2009/09_ september/06/binnenland/kaart-Afghanistan-Uruzgan800.jpg on November, 30, 2009.

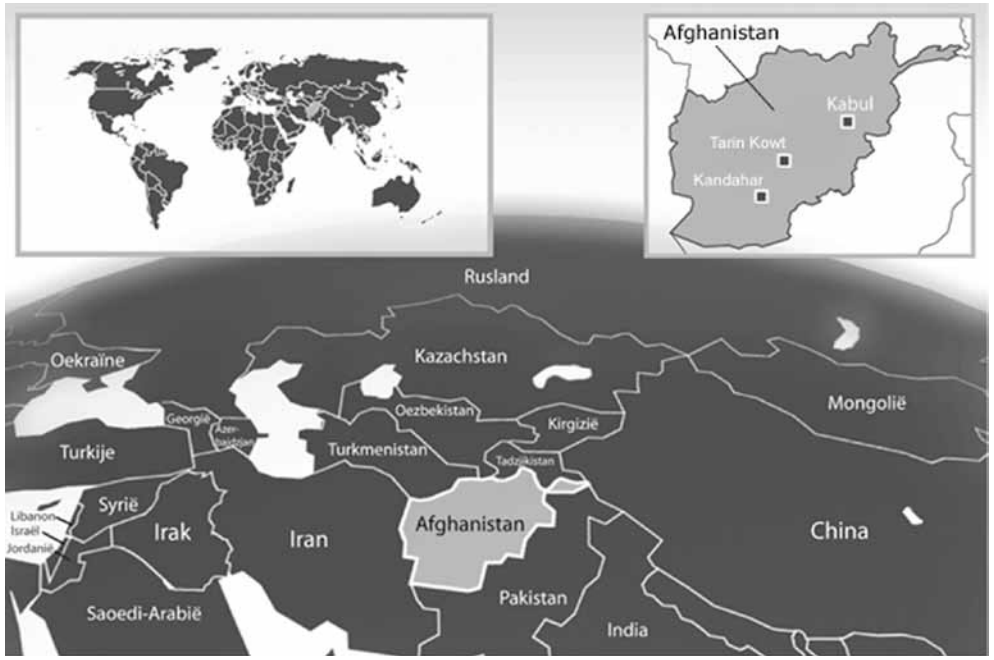

Figure 7: *Afghanistan.*

Figure 8: *Uruzgan.*

Bosnia-Herzegovina

The Netherlands have deployed military troops to the former Republic of Yugoslavia, since the early 1990s (see Figures 9 and 10).[21] Due to the situation in that area, the size and tasks of the troops deployed differed considerably during the years. In recent years, the Dutch involvement in the former republic is modest. In Bosnia-Herzegovina the troops mainly assist the government in combating (organized) crime, providing for border control against smuggling, and the disarmament of the population. Moreover, the troops monitor the democratic and economic development of the country, and assist the government with these developments. The troops that participated in this study in Bosnia-Herzegovina operated under relatively safe circumstances which can be compared to "normal" policing activities.

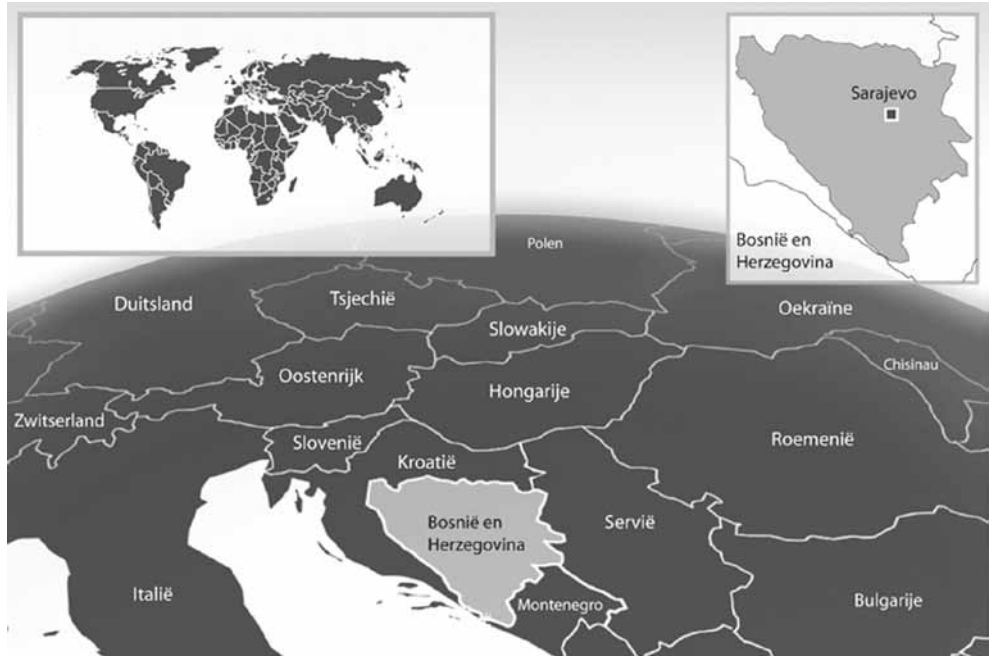

Figure 9: *Bosnia-Herzegovina.*

[21] Figure 9 was downloaded from http://www.defensie.nl/missies/bosnie/ on August, 26, 2009. Figure 10 was downloaded from http://commons.wikimedia.org/wiki/File:Bosnia_and_Hercegovina_map.png on March, 6, 2010.

Figure 10: *Bosnia-Herzegovina in detail.*

4.2.2 Organizational structure in the Royal Netherlands Army

In general, the Royal Netherlands Army is built up of several hierarchical levels. The cornerstone is the team. The size of a team may differ considerably, but most teams consist of about eight to ten personnel. Several teams that have more or less the same function (e.g., infantry, or logistics) may be grouped into a platoon. Although platoons may also differ in size, most platoons are composed of approximately forty personnel. Although platoons may operate more or less independently, most platoons that have the same function are grouped into a company. A typical company consists of three or four platoons, with in total approximately 120 to 160 personnel. Several companies with more or less the same function (e.g., infantry) may be grouped into a battalion, whereas several companies and platoons with different functions may be grouped into a battlegroup. A mix of several companies with different functions together with one or more battalions or battlegroups may be grouped into a brigade or a task-force.

4.2.3 Participating military units

Afghanistan

Several units, grouped in two successive Task Forces participated in this study. Task Force 1 was deployed from December 2006 until March 2007. It consisted of the Provincial Reconstruction Team (PRT), the Battlegroup (BG), the Engineer Company (EC), a Logistical Support Detachment (LSD), a Special Forces platoon (SF), and the Intelligence, Surveillance, Target Acquisition, and Reconnaissance unit (ISTAR). The BG was composed of three (mechanized) infantry companies and a support element, consisting of a staff unit, a reconnaissance platoon, a medical platoon, and an artillery platoon. In addition, the Task Force, consisted of three other units that did not take part in the study. These are a Psychological Support Element, a National Intelligence Support Element, and the staff of the Task Force. Task Force 2 was deployed from April 2007 until July 2007. The units that took part in this study are the BG, the EC, the LSD, the Joint Support Detachment (JSD), and ISTAR. Other units of Task Force 2 did not participate in this study. Most troops that participated in this study regularly worked outside Forward Operating Bases located near Tarin Kowt and Deh Rawod, two small cities in Uruzgan.

The teams in Afghanistan that took part in this study varied in the tasks they had to perform. Among the teams were (armored) infantry groups, sniper groups, artillery guns, mortar groups, medical aid groups, supply teams, reconnaissance groups, engineer groups, forward observation teams, forward air control teams, explosives demolition teams, and command teams. A large part of the teams in this study conducted (long range) patrols, escorted (supply) convoys or reconstruction teams, manned strongholds and outposts, and were engaged in combat operations. The size of the teams differed, but a large part of the teams in the study were (armored) infantry and engineer groups that consisted of about nine persons each. Most companies operated directly under command of the Task Force, except for the companies that were grouped into the BG. The BG itself operated under command of the Task Force also.

Bosnia-Herzegovina

Three units participated in this study. These units were deployed from December 2006 until May 2007 and were stationed at Banja Luka and Bugojno. The first unit was an infantry company (Inf coy) that conducted "policing activities".[22] Among these activities were searching houses in order to ascertain whether the inhabitants possessed illegal weapons ("harvest operations"), and preventing illegal logging in forests. The second company provided the logistical support (Spt coy) for all Royal Netherlands Army units in Bosnia-Herzegovina. The third unit that participated in this study was the Liaison and Observation Team (LOT) organization. Each LOT lived and worked in a house in a small village.

[22] This company originally belonged to the BG that was deployed to Afghanistan, early 2007.

These LOTs were spread around the South-Western part of the country (i.e., Drvar, Livno, Mrkonjić-Grad, and Travnik). In their region, each LOT monitored the democratic and economic development and reported their findings to the Headquarters of the Multi-National Forces in the South-Western part of the country (located at Banja-Luka).

Table 6 Presents an overview of the participating military units and the number of personnel in each unit.

4.3 Procedures of data collection

Two sources of information were used. First, the team members were asked to provide information on teamwork, their effectiveness and several factors that may have affected the development of teamwork over time. Second, the platoon leaders were asked to provide information on the effectiveness of the teams under their command. This section describes how the information was collected from the teams and platoon leaders.

4.3.1 Participating teams

It is difficult to conduct research using military troops that are deployed, especially when the circumstances in the area of operations are dangerous. Because of these circumstances, the military restricts the amount of visitors to troops deployed for safety reasons. Moreover, conducting research requires the use of scarce resources (e.g., means of transportation and housing for researchers, time for personnel to participate) which the military may be unwilling to provide considering the operation at hand. To overcome these barriers, the teamwork research was incorporated into the morale research which made it possible to obtain access to the area of operations and the units that were deployed.

All personnel belonging to the participating units were asked to fill out a questionnaire at two points in time. Time 1 was at the end of an extensive training period shortly before deployment on the fourmonth (Afghanistan)[23] or six-month (Bosnia-Herzegovina) mission abroad. The personnel belonging to one BG (belonging to Task Force 2), filled out the questionnaire while on field exercise in Germany, four months prior to deployment. All other units filled out the questionnaires while in the barracks in the Netherlands, two months prior to deployment. For the troops in Afghanistan, Time 2 was when the units had been deployed for about two months. For the troops in Bosnia-Herzegovina, Time 2 was about five months later than Time 1.

The commanders at different command levels were briefed in advance of our study to explain to them the aim and content of this study. At both measurement moments, the units were dispersed, with teams training at several training locations (Time 1) or operating at outposts (Time 2). This situation made the coordination and execution of the data collection difficult. Therefore, specific personnel belonging to the several subunits were asked to hand out the questionnaires, to instruct the respondents and to collect the questionnaires at times that were most convenient for each subunit within a bracket of about two weeks at both measurement moments. This specific personnel were handed an instruction how to introduce the questionnaire and how to safeguard respondent's confidentiality. Due to this procedure, it is not exactly clear how many soldiers were asked to participate in the study.

[23] Of the participating units in this study, the PRT was deployed for six months to Afghanistan.

Moreover, it should be noticed that both at Time 1 and 2 personnel may have been absent accounting for the different response rates and numbers of teams in the study. At Time 1, personnel may have been absent because some soldiers were following individual training courses at several different training centers at the time of the study, making it impossible to include them. At Time 2, personnel may have been absent because they were deployed at outposts or because they conducted long range patrols, so they could not be reached during the data collection, especially not when they were in contact with Opposing Militant Forces. At Time 2, some personnel may have been absent due to (temporary) repatriation because of personal circumstances. Both the LOT organization and ISTAR (belonging to Task Force 1) participated at Time 2 only. The former because LOTs do not train together before deployment and are formed in the area of operations. The ISTAR unit did not participate because the researchers were not able to contact the unit on time. The LSD and JSD (both belonging to Task Force 2) reorganized their structure and procedures while being deployed. Their commanders decided not to participate in the morale research (and therefore not in this teamwork research) at Time 2, because they expected the information obtained by the research to be outdated before it could be used. Although the respondents and teams at Time 1 were not exactly the same as those at Time 2, it is important to notice that the composition of the teams at this point of their preparation, and when being deployed, rarely changes and remains stable until redeployment.[24] Table 6 presents a comprehensive overview of the personnel strength of each unit that participated in this study, based on official organization figures.

4.3.2 Platoon level raters

At Time 1 and 2, we handed out a questionnaire to raters at the platoon level to assess the output of the teams under their command. Mostly, the raters at the platoon level were the platoon commander (mostly a lieutenant) and the deputy (mostly a sergeant). This level was chosen to provide the external team effectiveness ratings because the platoon level is the hierarchical level immediate above the team. Moreover, most operations in Afghanistan were conducted with platoons, without other hierarchical levels present "on the scene".[25] So, the platoon commander and his or her deputy may be expected to be the only ones external to the team to have a reliable, first-hand view on team performance. The raters were asked not to consult with each other, or other persons, when determining what ratings to provide to each team.

4.4 Response

4.4.1 Individual level response

As mentioned earlier, it is not possible to be exact on the number of team questionnaires that were handed out. A maximum of 2007 questionnaires were handed out at Time 1 and a maximum of 1820 questionnaires at Time 2. These numbers are the maximum personnel strength of the units, according to the official organization figures. We received 1498 questionnaires at Time 1 (response rate 74.6%) and 1360 questionnaires at Time 2 (74.7%). Table 6 presents the response for each unit that participated in this study.

[24] An example of "the exception to this rule" is provided in chapter 1. In October 2008, due to serious difficulties within teams and between teams and their superiors, several teams were disbanded, some personnel was repatriated home, and the remaining personnel was dispersed over other units.

[25] See "De luit in charge in Uruzgan" in Landmacht, July 2007.

Table 7 presents the characteristics of both samples. The samples mainly consist of young male soldiers and corporals. Still, except for gender, the Time 2 sample differs significantly from the Time 1 sample. Partly, this is because the Time 2 sample was taken several months following Time 1. So, military personnel are older and their tenure with the unit are longer. Moreover, the Time 2 sample contains significantly more non-commissioned officers (NCOs) and officers. This may also partly explain the differences between both samples since, compared to the soldiers and corporals, NCOs and officers are older (F [1, 996] = 892.6, p = .00), have been deployed more often (F [1, 1270] = 61.1, p = .00), and have a longer tenure with their unit (F [1, 1212] = 31.9, p = .00). Still, the respondents in both samples can be characterized as predominantly being young, male soldiers or corporals, having few experience with previous deployments, and being part of the team for approximately a year.

Table 6

Population and sample of military personnel

	Population		Sample			
	T1	T2	T1		T2	
	N	*N*	*N*	%	*N*	%
Afghanistan						
Task Force 1						
PRT	29	29	18	62.1	27	93.1
BG/coy 1*	144	144	139	96.5	133	92.4
BG/coy 2*	122	122	132	108.2	97	79.5
BG/coy 3*	122	122	89	73.0	104	85.2
BG/support	119	119	56	47.1	59	49.6
LSD	244	244	126	51.6	177	72.5
EC	87	87	66	75.9	55	63.2
SF	52	52	44	84.6	52	100.0
ISTAR	-	50	-	-	44	88.0
Task Force 2						
BG/coy 1*	122	122	106	86.9	87	71.3
BG/coy 2*	144	144	152	124.6	83	68.0
BG/coy 3*	122	122	81	66.4	116	95.1
BG/support	119	119	61	51.3	59	49.6
LSD	122	-	99	81.1	-	-
JSD	122	-	62	50.8	-	-
EC	116	87	101	87.1	74	85.1
ISTAR	50	50	41	82.0	40	80.0
Bosnia-Herzegovina						
Inf coy	80	80	75	93.8	72	90.0
Spt coy	91	91	50	54.9	50	54.9
LOT	-	36	-		31	86.1
Total	2007	1820	1498	74.6	1360	74.7

Note. *T1 = Time 1; T2 = Time 2. "-" Indicates that the unit did not take part at the study at a specific measurement moment. Units indicated with an asterisk (*) temporarily changed platoons or teams so the number of respondents may exceed the number of personnel according to the organization table.*

Table 7

Characteristics of the respondents in the sample

Characteristics	T1			T2			Difference between T1 and T2		
	%	*M*	*SD*	%	*M*	*SD*	*F*	*df*	*p*
Rank is soldier/corporal*	71.1	-	-	67.4	-	-	4.5	1, 2742	.03
Gender is male	94.7	-	-	95.2	-	-	.29	1, 2752	ns
Age (years)	-	25.3	6.5	-	26.0	7.4	6.6	1, 2219	.01
Number of previous deployments	-	1.0	1.5	-	1.2	2.0	7.1	1, 2702	.01
Tenure with the team (months)	-	11.9	11.3	-	14.1	12.1	22.6	1, 2607	.00

Note. *T1 = Time 1; T2 = Time 2. ns = not significant. * Other respondents are non-commissioned officers and officers.*

4.4.2 Team level response

The respondents were grouped into their respective teams, based on the name of their team leader and unit identification they provided. At Time 1, 302 respondents provided no or inadequate information of the team they belonged to. Two respondents, together representing one team, provided no information on teamwork aspects. The remaining 1194 respondents belonged to 236 teams with at least two respondents in each team. On average a team was represented by 5.1 respondents (SD = 2.5). At Time 2, 330 respondents provided no or inadequate information of the team they belonged to. The remaining 1032 respondents belonged to 208 teams with at least two respondents in each team. On average a team was represented by 5.0 respondents (SD = 2.4). See Table 8 for detailed information.

Each respondent was asked to provide his or her personal identification number. Based on this number, responses of military personnel on Time 1 could be matched with their responses on Time 2. In total 584 respondents, belonging to 144 teams participated at Time 1 and 2.[26] On average these teams were represented by 4.1 respondents (SD = 1.9).

[26] Although most respondents provided their identification number, a considerable amount of respondents could not be matched. When analyzing the results it appeared that the optical reader that was used to scan the questionnaires had failed to read the numbers accurately. Manual inspection of the questionnaires was not possible because the questionnaires were burned in the area of operations since the questionnaires provided confidential (morale) information and the researchers were not able to take the questionnaires with them, when leaving the area.

4.4.3 *Team effectiveness ratings*

From the 236 teams that participated at Time 1, 114 teams (48.3%) were rated by, on average, 1.7 raters (*SD* = .56) at the platoon level. From the 208 teams that participated at Time 2, 90 teams (43.3%) were rated by, on average 1.8 raters (*SD* = .56) at the platoon level. From the 144 teams that participated at both Time 1 and 2, 75 teams (52.1%) received an external rating of effectiveness at Time 1, 69 teams (47.9%) received an external rating of effectiveness at Time 2, and 48 teams (33.3%) received an external rating of effectiveness at both measurement moments.

Table 8

Sample of military teams with at least two respondents in each team

	Teams	
	T1	T2
Afghanistan		
Task Force 1		
PRT	3	4
BG/coy 1	20	19
BG/coy 2	23	16
BG/coy 3	16	16
BG/support	10	8
LSD	24	26
EC	11	9
SF	5	5
ISTAR	-	5
Task Force 2		
BG/coy 1	16	15
BG/coy 2	25	15
BG/coy 3	16	14
BG/support	10	9
LSD	11	-
JSD	5	-
EC	14	15
ISTAR	6	6
Bosnia-Herzegovina		
Inf coy	13	12
Spt coy	8	8
LOT	-	6
Total number of teams	236	208
Total respondents in teams	1194	1032

Note. *T1 = Time 1; T2 = Time 2.*

4.5 Instruments

4.5.1 *Introduction*

In this study, team members were asked to fill out a questionnaire, originally compiled in Dutch. In essence this was the Dutch Morale Questionnaire with additional items that were specifically developed for this study. This section describes the items that were used to measure the constructs in the conceptual model (see Table 9 for an overview). Vertical cohesion appears twice in the overview of measured constructs. Besides vertical cohesion with the team leader, also vertical cohesion with the platoon leader was measured since the teams mostly operated under direct control of the platoon leader. In addition, platoon level raters were asked to rate the team's output. The instrument that was used for this purpose will be described also. Finally, the discriminant validity of the constructs and their reliabilities will be analyzed.

Table 9

Overview of constructs in this study, measured at the individual team member level

Teamwork	
	Team leadership
	Team orientation
	Mutual performance monitoring
	Backup behavior
	Adaptability
	Mutual trust
	Shared mental models
	Closed-loop communication
Team effectiveness	
	Team output
	Cohesion*
	Respect*
Antecedents of change in teamwork	
	Potency*
	Vertical cohesion with team leader*
	Vertical cohesion with platoon leader*
	Inter-team cooperation
	Satisfaction with job characteristics*

Note. *The Dutch Morale Questionnaire measures the constructs marked with an asterisk (*).*

4.5.2 *Teamwork constructs, measured at the individual team member level*

55-items were developed to measure the eight teamwork constructs. The items were specifically generated for this study, based on the definitions of the components and behavioral markers for each teamwork construct as provided by Salas et al. (2005; see Table 5). The items were newly developed in order to come as close as possible to the meaning of each construct as defined by Salas et al. (2005). See Appendix C for the items and their response options that were used to measure team leadership, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental models, and closed-loop communication.

4.5.3 Team effectiveness constructs, measured at the individual team member level

Team output was measured with three items. These items were constructed for the present study. Cohesion was measured using five items. These items originate from the Dutch Morale Questionnaire. Respect was measured using four items. These items also originate from the Dutch Morale Questionnaire. See Appendix C for the items and their response options that were used to measure team output, cohesion, and respect.

4.5.4 Antecedents of change in teamwork, measured at the individual team member level

Potency was measured using five items, originating from the Dutch Morale Questionnaire. Vertical cohesion with the team leader, and with the platoon leader were each measured using seven items originating from the Dutch Morale Questionnaire. Inter-team cooperation was measured using three items that were developed for this study. Satisfaction with job characteristics was measured using five items that originate from the Dutch Morale Questionnaire.

See Appendix C for the items and their response options that were used to measure potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, and satisfaction with job characteristics.

4.5.5 Team output, measured at the platoon level

At the platoon level a short questionnaire with nine items was used to rate the team's output. All items were originally compiled in Dutch and developed for this study. See Appendix C for the items and their response options that were used to measure team output as rated by platoon level raters.

4.6 Discriminant validity and reliability of variables

4.6.1 Testing for the one-dimensionality of the constructs

First we tested the one-dimensionality of the sixteen constructs. Therefore, an Exploratory Factor Analyses (EFA; Extraction method is Principal Components with a minimum Eigenvalue of 1, using Direct Oblimin rotation) was conducted using SPSS to analyze whether the items of a construct loaded on one factor. The analyses were performed twice, first by using the dataset obtained at Time 1 and second by using the Time 2 dataset.

Based on the Time 1 dataset, it appeared that the EFAs revealed a one-factor solution for all constructs, except for the team leadership scale (see Table 10). The eleven items of the team leadership scale loaded on two factors. Items 1 through 6 loaded on the first factor (explained variance 62.3%) and the remaining items loaded on the second factor (explained variance 9.7%). An EFA on items 1 through 6 revealed a one-factor solution and an EFA on items 7 through 11 also revealed a one-factor solution.

The analyses conducted with the Time 2 dataset confirmed the results with the Time 1 dataset (see Table 10). Again, it appeared that the EFAs revealed a one-factor solution for all constructs, except for the team leadership scale. The eleven items measuring team leadership loaded on two factors (items 1 through 6 loading on the first factor; explained variance 65.8%; items 7 through 11 loading on the second factor; explained variance 9.1%).

Based on the results of these EFAs, the initial team leadership scale was divided in two scales. The leadership items 1 through 6 describe behaviors that a team leader displays before a team executes its task to get the team members in the right mindset and prepare them for the task at hand. Therefore, this scale will be labelled *team briefing*. The remaining leadership items describe behaviors that a team leader displays while a team executes its task. Therefore, this scale will be labelled *team leadership*.

As can be seen in Table 10, all Cronbach's alphas were .70 or above, indicating reliably measured scales at Time 1 and 2. The reliability of the team output, and satisfaction with job characteristics scales at Time 1 and 2 could be improved by removing one item from the respective scales. However, since all scales were one-dimensional, and the reliability of each scale was acceptable, no items were removed at this point.

Table 10

Results of Exploratory Factor Analyses and reliability tests

Construct	# Items	Time 1		Time 2		Remarks
		Explained variance EFA	Cronbach's α	Explained variance EFA	Cronbach's α	
Team leadership	5	68.0	.88	71.0	.90	-
Team briefing	6	75.3	.93	78.2	.94	-
Team orientation	6	71.4	.92	74.9	.93	-
Mutual performance monitoring	4	74.1	.88	78.7	.91	-
Backup behavior	5	79.0	.93	82.7	.95	-
Adaptability	8	64.5	.92	69.1	.93	-
Mutual trust	9	65.8	.94	69.9	.95	-
Shared mental models	9	65.8	.93 (.94)	69.8	.95	Removing item 8 improves α on Time 1
Closed-loop communication	3	73.6	.82	78.6	.86	-
Team output	3	72.0	.80 (.83)	75.8	.84 (.86)	Removing item 3 improves α on Time 1 and 2
Cohesion	5	63.5	.86	68.5	.88	-
Respect	4	80.9	.92	82.8	.93	-
Potency	5	65.0	.87	74.3	.91	-
Vertical cohesion with the team leader	7	63.1	.90	73.3	.94	-
Vertical cohesion with the platoon leader	7	66.9	.92	74.7	.94	-
Inter-team cooperation	3	72.2	.81 (.82)	76.7	.85	Removing item 1 improves α on Time 1
Satisfaction with job characteristics	5	52.5	.75 (.80)	57.0	.80 (.83)	Removing item 5 improves α on Time 1 and 2
External rating of team output	9	56.9	.90	59.0	.91	

Note. *A value in parenthesis indicates the reliability for the scale when a specific item (see remarks) is removed.*

4.6.2 Testing for the discrimant validity of the constructs

The next step was testing the discriminant validity of the seventeen constructs for which the data were provided by the team members. This was done by conducting a maximum-likelihood confirmatory factor analysis (CFA) with AMOS 7 (Arbuckle, 2006). We specified a model with seventeen latent factors representing each construct. All items loaded on their respective factor. The seventeen latent factors were allowed to correlate with each other. The CFA was conducted on the combined Time 1 and 2 sample so the amount of respondents (N = 2858) compared to the amount of items (94 items) is more favorable than when the CFA was conducted twice on each subsample ($N_{sampl\ A}$ = 1498; $N_{sample\ B}$ = 1360).

Several indices can be used to test the fit of the model. Kline (2005) suggested to use the confirmatory fit index (CFI), the root mean square error of approximation (RMSEA) and its 90% confidence interval, and the standardized root mean square residual (SRMR) for determining model fit. As suggested by other researchers, a good-fit model requires that the values of the CFI should be higher than .90, the value of the RMSEA should be lower than .05 to indicate close approximate fit (values between .05 and .08 suggest reasonable error of approximation, whereas values >= .10 indicate poor fit), and the SRMR should be lower than .10. In addition, the χ^2 will be reported because it is mentioned in almost all reports (Kline, 2005). Since the χ^2 is sensitive to sample size (Kline, 2005), this index, however, will not be used to assess model fit in this study.

As can be seen in Table 11, the model fitted the data well. One item had a relatively low loading (<.50) on its construct. This item was item 5 from the satisfaction with job characteristics factor. Removing this item would improve the reliability of the satisfaction with job characteristics scale (see Table 10). Therefore, the analysis was re-run with an adjusted model in which item 5 from the factor satisfaction with job characteristics did not load on that factor, but was a factor itself, labelled feedback. The remaining four items from the satisfaction with job characteristics scale loaded on a factor which was labelled challenging work. This adjusted model fitted the data well. Moreover, the difference in χ^2 between the initial and adjusted model, and the difference in degrees of freedom between the initial and adjusted model were calculated. Consequently, the significance of $\Delta\ \chi^2$ with $\Delta\ df$ was calculated to assess whether the fit of the adjusted model improved significantly as compared to the initial model. Since the fit of the adjusted model improved significantly ($\Delta\chi^2$ = 153.2, $\Delta\ df$ = 16, p = .00), this adjusted model was accepted. Table 11 presents the fit indices for this adjusted model.

Appendix D presents the unstandardized and standardized regression weights for the adjusted model based on the combined Time 1 and 2 dataset. All standardized regression weights were .60 or above, indicating that the remaining items were strong predictors of their respective constructs. These results supported the discriminant validity of the constructs in this study for which the data were obtained by the team members.

Table 11

Fit indices for Confirmatory Factor Analyses

Model	χ^2	*df*	*p*	CFI	RMSEA	(90% confidence interval)	SRMR	Items with factor loading < .50
Initial	19991.4	4141	.00	.92	.04	(.04 - .04)	.03	Satisfaction with job characteristics item 5 = .36
Adjusted	19838.2	4125	.00	.92	.04	(.03 - .04)	.03	

Note. *N = 2858. AMOS allows no missing data when estimating values for the SRMR. So, the SRMR values in the Table are based on a CFA with a subset of the data with no missing values (N = 1490). The values for the SRMR, therefore, are indicative for the whole sample.*

The one-dimensionality and reliability of the platoon level rating of team output was assessed also. The EFA revealed a one-factor solution for these nine items. This factor explained 56.9% (Time 1) and 59.0% (Time 2) of the variance. Cronbach's alpha for this team output scale was .90 (Time 1) and .91 (Time 2). The scores on the nine items were averaged for each rater. Consequently the scores provided by several raters for each team were averaged leading to one team level score for team output as rated at the platoon level.

4.7 Data aggregation

4.7.1 Transforming individual level scores into team level scores

The object of this study is the team. The question is how teamwork within teams affects the team's effectiveness and what factors influence that teamwork within teams over time. So, it is not the individual team member this study is interested in but the functioning of the team. The information about teamwork and team effectiveness, however, is collected at the individual level, except for the platoon level rating of team output. That is, team members are asked how they perceived the teamwork KSAs of interest being conducted within the teams and their team's effectiveness. To analyse these individual level data and to infer conclusions about team functioning based on individual level analysis, would, however, be a mistake which is often labelled "the atomistic fallacy" (e.g., Bliese & Jex, 2002; Kozlowski & Klein, 2000) or the "fallacy of the wrong level" (Dansereau, Cho, & Yammarino, 2006). Therefore, individual level scores have to be transformed into team level scores.

Before several issues concerning transformations are outlined, it should be mentioned that, although this study relies on individual level scores transformed into team level scores, it is possible to obtain team level scores without transformations. For example, an observer might assess team performance and rate the occurrence of behaviors within that team. In fact, something similar has been done in this study by asking platoon level raters to assess team output. Although these team effectiveness scores are obtained from one (or more) individual(s), these scores do not have to be transformed since these scores represent the output of the team as a whole. So, why not observe team functioning and make inferences on that observations about teamwork within teams? There are two reasons for that. First, several aspects of teamwork are hardly or not directly observable, for example mutual trust or shared mental models. This implies that one has to rely on team member's self-reports to obtain information

about the presence of this attitude (mutual trust) and cognition (shared mental models) when team members work together on team tasks. Second, it is hardly possible to observe teams functioning while being deployed in Peace Support Operations for longer periods of time. It takes a lot of time and manpower to accurately observe one team for some time, let alone to observe several teams for longer periods of time. Because of this time consuming aspect, it is not reasonable to ask military personnel to observe the teams functioning in detail since military personnel are always scarce and operational relevant tasks are abundant. In addition, even if the time and manpower were no problem because researchers are available, then the military might be very reluctant to allow these researchers to accompany the teams since most teams perform their tasks under dangerous circumstances. The military would not take the risk of people getting wounded or killed that had no operational necessity of being present when difficulties arise.[27]

Therefore, this study relies on individual team member's assessment of teamwork KSAs and other variables of interest. Each team member is regarded an expert informant because each of them was able to directly observe the team's performance and because each of them has unique knowledge of their team's functioning across a wide range of situations. Nevertheless, the individual level scores must be transformed into team level scores.

When transforming individual level scores into team level scores, three issues must be addressed. First, it should be made clear what mechanism accounts for the transformation. Second, there are several ways to transform individual level scores into team scores. What is the difference between them, and what ways are appropriate in this study? Third, what empirical evidence supports the transformation of individual level scores into team level scores? These three issues will be dealt with below.

4.7.2 Emergence

The mechanism that accounts for the transformation is emergence (see Kozlowski & Klein, 2000). KSAs originate at the individual level but emerge to the team level where they manifest themselves. When KSAs of team members – and their interactions – are shared among team members, they coalesce and converge among team members and in that characterize the team as a whole. Critical in this is the sharedness among team members, but where does the sharedness comes from? In military teams several processes affect team members sharing ideas, moods, feelings, experiences, et cetera. First, teams are trained and socialized together. Although each soldier starts with an individual basic training, after that, most of the soldiers will remain within a team, the rest of their military career. Besides some individual courses, most advanced training is training team tasks together with their team members. So most experiences are team experiences, shared by the team members. Second, most work will be performed with the team members working together on team tasks. When working on these tasks, each team encounters unique situations and circumstances. All these experiences and the sensemaking of it are shared among the team members. Third, intense social interaction takes place within the team. When deployed, military teams are like families that work and live together intensely for months.

[27] This problem was especially relevant in the early stage of the mission in Uruzgan (2006 and 2007) since it was unclear what the amount and impact of hostilities would be. In this period, this study was conducted. In the later stages, when the troops got familiar with the situation in Uruzgan, for example, journalists were embedded with the troops, and musicians were allowed to visit the troops to provide for welfare and recreation for the troops.

So, training, socializing, and working together as a team, together with intense social interaction when working and living together, all contribute to sharedness of characteristics, attitudes, behaviors, and cognitions within the team.

4.7.3 Composition models

Several composition models (Chan, 1998) exist that can be used to compose constructs at a higher level of analysis, based on lower level information. A composition model specifies the functional relationship among constructs at different levels "that reference essentially the same content but that are qualitatively different at different levels" (Chan, 1998, p. 234). So, a composition model describes the transformation process for constructs from one level to another. In this study, two composition models are used which are the direct consensus model and the referent-shift consensus model. Appendix E presents the variables in this study with the composition model used to transform individual level scores to team level scores.

If perceptual agreement within the unit of analysis is of concern, the direct consensus model is appropriate (Chan, 1998). This model uses within-group agreement as an indication of consensus at the lower level of analysis. When consensus is high, team members share the same meaning on the construct of interest. The sharedness constitutes the functional equivalence between the constructs at both levels (Chan, 1998). In this study, respect is an example of a team construct based on the direct consensus model. When team members within a team highly agree on being respected, then at the team level, respect within the team is high.

The referent-shift consensus model is an extension of the direct consensus model. The critical difference, however, is that there is a shift in the referent prior to consensus assessment (Chan, 1998). In this study several constructs are measured by asking team members how they think others in the team behave, think, or feel as opposed to how the team member behaves, thinks, or feels him or herself. So, for these constructs there is a shift from "I" to "the team". When using referent-shift consensus models, team members agree on other team member's perceptions of the construct of interest.

4.7.4 Tests for within team agreement

If perceptual agreement among group members is the chief concern, which is the case in both direct and referent-shift consensus models, the intraclass correlation coefficient ICC(1) should be used as the primary basis for deciding whether to aggregate the data (James, 1982). Therefore, the ICC(1) was calculated for each team level variable to determine the amount of variance in individual level responses that can be explained by group level properties (Castro, 2002). An additional advantage of the ICC(1) is that it is not biased by group size or the number of groups in the sample, so ICC(1) values are directly comparable across studies (Bliese & Halverson, 1996). James (1982; see also Bliese & Halverson, 1996) indicated that ICC(1) measures generally range from 0 to .50 with a median of .12. Based on his research, however, Bliese (2000) indicated that ICC(1) values typically range from .05 to .20. There are, however, no definite guidelines for determining acceptable ICC(1) values (Bliese & Halverson, 1996). Perhaps because of this lack of guidelines, Klein et al. (2000) mentioned that researchers who use ICC(1) to justify aggregation do so if the F-value is significant. Therefore, in this study an F test from a one-way analysis of variance (ANOVA; see e.g., Chen, Kirkman, Kanfer, Allen, & Rosen, 2007) was calculated.

In addition to ICC(1) and the F-test, the intraclass correlation coefficient ICC(2) was calculated (Bliese & Halverson, 1996; Chen, Kirkman, et al., 2007; Stewart & Barrick, 2000). The interpretation of the ICC(2) is that "if another sample of n_k individuals were sampled randomly from each of the same *K* [teams], then the correlation between the two sets on *X* would be approximately equal to ICC(2)" (James, 1982, p. 222). The ICC(2) may therefore be used as a measure of reliability of group means (Bliese & Jex, 2002; James, 1982). According to Bliese and Jex (2002), the ICC(2) provides the most evidence that the group mean measures an emergent construct that is different from its individual-level counterpart. If the ICC(2) "is at or near zero, then there is little empirical support to suggest that the group mean is measuring something distinct from the individual-level variable"(Bliese & Jex, 2002, p. 269).
A disadvantage of the ICC(2) is that its value is affected by group size. Calculations of ICC(2)s with larger groups result in more reliable estimates of group means (i.e., higher ICC(2) values; Castro, 2002).

4.7.5 Results for aggregation tests

Appendix E presents the results. On Time 1, the ICC(1) values ranged from .04 (respect) to .25 (team leadership and vertical cohesion with the team leader). The mean ICC(1) was .16. At Time 2, ICC(1) values ranged from .04 (feedback) to .26 (team briefing). The mean ICC(1) was .18. The ANOVA results indicated that the average scores for all variables differed significantly between teams at Time 1 and 2.

At Time 1, the ICC(2) values ranged from .17 (respect) to .63 (team leadership and vertical cohesion with the team leader). The mean ICC(2) was .48. At Time 2, the ICC(2) values ranged from .18 (feedback) to .63 (team briefing). The mean ICC(2) was .50.

The ICC(1) results fell within the typical range (except for respect at Time 1 and feedback at Time 2) and all results from the one-way ANOVA indicated that average scores for all variables differed significantly across teams. In addition, ICC(2) values were not "at or near zero", even with the relative small group sizes at Time 1 and 2 (*M* = 5.1 at Time 1 and *M* = 5.0 at Time 2; as calculated with the formula for N_G; see Bliese & Halverson, 1996). So, there was sufficient support for the aggregation of the data to the team level (see e.g., Castro, 2002; Chen, Kirkman, et al., 2007). Consequently, since consensus accounted for the team level scores to merge, the team scores for the variables (see Appendix E) were calculated as the mean scores of the individual team member scores on each variable.

4.8 Summary

This chapter described how the study was conducted. Military personnel belonging to several units that prepared for Peace Support Operations in Afghanistan and Bosnia-Herzegovina were invited to participate in a survey study which measured teamwork KSAs and several other constructs of interest. While being deployed, the troops were invited again to participate in a survey study. In total, 1498 soldiers (response = 74.6%) participated in this study at Time 1, and 1360 soldiers (response = 74.7%) at Time 2. Most of the soldiers could be grouped into teams that were represented by at least two respondents (Time 1, 236 teams; Time 2, 208 teams; 144 teams with at least two respondents participating at Time 1 and 2). In addition, platoon level (non commissioned) officers were invited to fill out a short survey that assessed the team's output.

The chapter described the instruments that were used to collect the data. Moreover, it was analyzed whether the constructs were reliably measured, and possessed discriminant validity. This proved to be the case. Consequently, it was analyzed whether the data, that were obtained at the individual level, could be aggregated to the team level to represent team constructs. The analyses provided support for this aggregation. In Chapter 5 and 6, these team level constructs will be used to test the hypotheses that were formulated in Chapter 3.

5.

Analyzing the relations among teamwork variables and between teamwork and team effectiveness

5. Analyzing the relations among teamwork variables and between teamwork and team effectiveness

5.1 Introduction

In the military, most tasks during Peace Support Operations are performed by teams that regularly operate under dangerous and threatening circumstances. For such teams to be effective, the ability to work together on those tasks, or teamwork, is crucial. Unclear, however, is what this teamwork is about. Therefore, the purpose of this study is to provide more insight into teamwork in the military and the following research question was formulated. *'What KSAs subsume teamwork and how are the KSAs related to each other and to team effectiveness?'*. The answers to this question may provide team leaders and members, and those who train and lead them, with insights on how to enhance team performance, especially when preparing for, or when conducting, Peace Support Operations. This chapter addresses this question by studying teamwork within military teams.

In Chapter 2, the literature on teams, teamwork, and team effectiveness was reviewed. This review led to eight KSAs that may subsume teamwork. These KSAs are team leadership, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental model, and closed-loop communication. In addition, the literature provided insight on possible relations between these teamwork KSAs and between teamwork and team effectiveness. The latter appeared to be a multifaceted construct with team output, cohesion, and respect as its indicators.

In Chapter 3, twenty-four hypotheses were formulated that captured the relations between the eight teamwork KSAs and between the eight teamwork KSAs and team effectiveness. These hypotheses are summarized in Figure 11.

It should be noticed in Figure 11, that the original teamwork construct team leadership has been replaced by team leadership behaviors. This is because the test for discriminant validity of the constructs in the model (see Chapter 4) revealed that team leadership subsumes two distinct constructs (i.e., team leadership and team briefing). Therefore, team leadership and team briefing will be regarded indicators of the latent, or not observed, construct labeled team leadership behaviors that replaces team leadership in the hypothesized model in Chapter 3. In Figure 11, team effectiveness also appears as a latent construct with team output, cohesion, and respect as its indicators. Finally, the exogenous constructs in the model (i.e., mutual trust, *team leadership behaviors*, team orientation, shared mental models, and closed-loop communication) are correlated. For clarity reasons, these correlations are omitted in Figure 11.

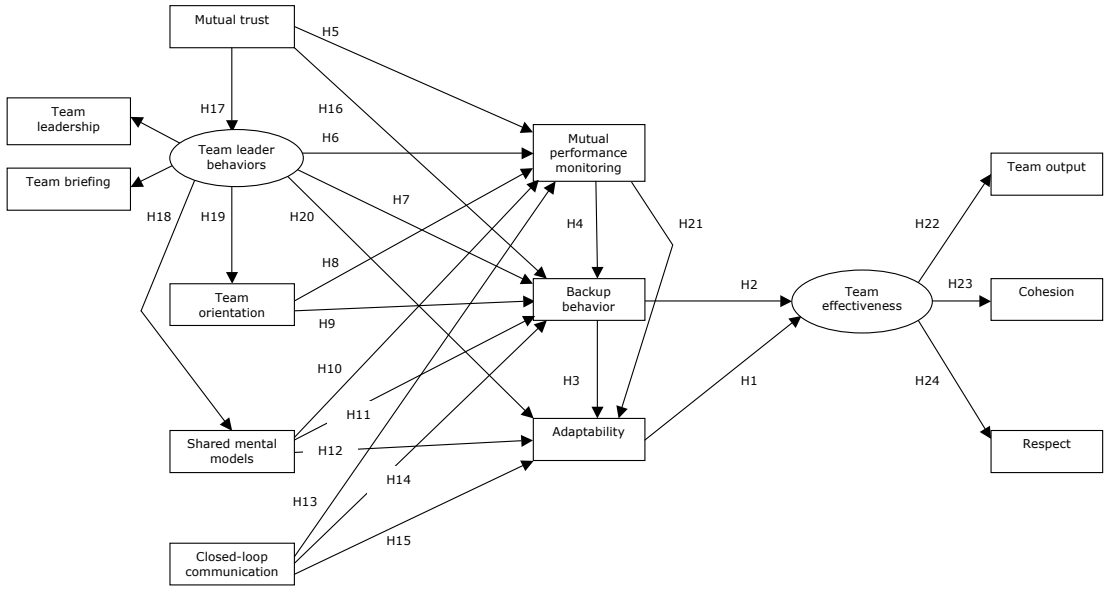

Figure 11: *Hypotheses. The variables captured in rectangles are observed variables. The variables in ovals are latent, or not-observed, variables. Mutual trust, team leader behaviors, team orientation, shared mental models, and closed-loop communication are correlated. H = hypothesis.*

5.2 Method

5.2.1 *Sample and procedure of data collection*

The sample consisted of military teams that participated in a survey study at two moments in time. Time 1 was at the end of an extensive training period, two to four months before deployment on a Peace Support Operation to Bosnia-Herzegovina or Afghanistan. The deployment in Bosnia-Herzegovina lasted six months, whereas the deployment in Afghanistan lasted four months. Time 2 was at mid-deployment.[28] The participants that were deployed to Afghanistan belonged to two successive Task Forces. Each Task Force consisted of several units, among them the Battlegroup. Most of the participants that were deployed to Bosnia-Herzegovina originally belonged to the Battlegroup of the first Task Force which was deployed to Uruzgan. At Time 1, 236 military teams took part in the study and 208 military teams took part in the study at Time 2. Each team was represented by at least two respondents ($M_{Time\ 1}$ = 5.1, $SD_{Time\ 1}$ = 2.5; $M_{Time\ 2}$ = 5.0, $SD_{Time\ 2}$ = 2.4). All measures were self-reported measures at the team level. See Chapter 4 for all details concerning the participating units, the respondents, the questionnaires used, how the study was conducted, and how the variables were aggregated from the individual level to the team level.

[28] A few teams were deployed for six months in Afghanistan; for these teams, Time 2 was when the teams had been deployed for two months.

5.2.2 *Analyses*

First, the means, standard deviations, and correlations between the constructs in the model were computed. Following that, the hypotheses were tested integrally by using structural equation modeling (SEM) with AMOS 7.

First, the fit of a model containing hypotheses 1 through 15, and hypotheses 22 through 24 was tested. In essence, this is the model as proposed by Salas et al. (2005) with the effects of closed-loop communication on teamwork KSAs added, and with team effectiveness as a latent factor and team output, cohesion, and respect as indicators for team effectiveness. This model will be referred to as 'model 1'. The CFI (> .90), RMSEA with its 90% confidence interval (< .05 for good fit, and between .05 and .08 for reasonable fit, and >= .10 for poor fit) and the SRMR (< .10) were used for assessing model fit.

Second, the fit of the model containing hypotheses 1 through 24 was tested. This model will be referred to as 'model 2'. In this model 2, the relations between teamwork KSAs that were not incorporated in model 1, but that were suggested by Salas et al. (2005), were added. Moreover, it was assessed whether adding these relationships improved overall model fit by calculating the significance of $\Delta\ \chi^2$ with Δ df.

Third, the fit of 'model 3' in which non-significant paths in model 2 were removed was tested . Also it was analyzed whether the overall fit of model 3 changed significantly as compared to model 2.

Fourth, it was analyzed whether it was necessary to add paths or correlations to model 3, that were not hypothesized in advance. A path or correlation was added if model 3 did not reach acceptable fit and adding the path or correlation would lead to an acceptable fit of this 'model 4' and led to a significant improvement of overall fit of model 4 as compared to model 3. Therefore, modification indexes provided by AMOS were inspected. AMOS calculates modification indexes (i.e., the increase in model fit expressed in χ^2 with one degree of freedom) for each path or correlation which is fixed to zero. Consequently the model fit was assessed, and it was assessed whether the overall fit of model 4 changed significantly as compared to model 3.

Following this procedure, which Kline (2005, p. 145) referred to as model "building" (i.e., adding paths) and "trimming" (i.e., removing paths), the model remains as parsimonious as possible when reaching acceptable fit. However, model building may lead to Type I errors (i.e., including paths or correlations in the model that are significant in the dataset by chance; Kline, 2005). Model trimming, on the other hand, may lead to type II errors (i.e., dropping a path in the model that corresponds to a true nonzero causal effect that is statistically non significant in the dataset; Kline, 2005).

To address this issue of type I and II errors in the analyses, the dataset was divided up into two halves. The first halve consisted of teams of Task Force 1 that took part in the study at Time 1 and teams of Task Force 2 that took part at Time 2 (i.e., sample A).[29] The second halve consisted of teams of Task Force 1 that took part at Time 2 and teams of Task Force 2 that took part at Time 1 (i.e., sample B). By splitting the dataset this way, no team appeared twice in one subset. Moreover, eventual effects of time (1 and 2) and task force (1 and 2) were divided up into both subsets. See Table 12 for the number of teams in each sample.

[29] The teams that were deployed to Bosnia-Herzegovina were assigned to Task Force 1 since most troops that were deployed to Bosnia-Herzegovina originally belonged to the Battlegroup that was part of Task Force 1.

Table 12

Number of teams in each sample

Task Force \ Time	1	2
1	133	134
2	103	74

Note. *The shaded cells comprise sample A (N = 207). The white cells comprise sample B (N = 237).*

Following this procedure, each model was analyzed using sample A. Next, it was analyzed whether adjustments to the model held when using sample B. It is argued that model building and trimming based on empirical or theoretical evidence found in the literature, and analyzing each adjusted model in two samples, safeguarded against the Type I and II errors. Moreover, this post hoc model modification might lead to new insights on how the variables in a model are related to one another, given the requirement that the initial model was based on sound empirical and/or theoretical evidence (Kelloway, 1995). It is argued that this requirement holds for models 1 and 2.

AMOS allows no missing values when assessing modification indexes or the value for the SRMR. However, in sample A, 1 team missed a value for team output whereas in sample B three teams missed values for cohesion and respect. For these 4 teams, the missing values were replaced by the overall mean for the respective variables.

5-3 Results

5-3-1 Means, standard deviations, and correlations

Table 13 presents the means and standard deviations for the variables in the model. The correlations between the variables are also presented in Table 13. Several correlations between teamwork variables exceed .80 indicating substantial overlap between the variables concerned. Although the CFA provided support for the discriminant validity of the measures at the individual level (see Chapter 4), high correlations between variables at the team level may cause collinearity in regression and path analyses. Collinearity may lead to increased uncertainty (standard errors) and inaccuracy (slope coefficients; Miles & Shevlin, 2001). Therefore, a test for collinearity was conducted by performing nine regression analyses. In each regression analysis, one of the nine teamwork variables was used as a dependent variable, whereas the remaining eight variables were used as independent variables. The combined Time 1 and 2 dataset was used for these analyses. Each analysis revealed the r2 for the dependent variable, meaning the amount of variance that teamwork construct shares with the other eight variables. Moreover, each regression analysis revealed the tolerance and variance inflation factor (VIF). The tolerance (= 1 – r^2) is the extent to which the dependent variable cannot be predicted by the independent variables (Miles & Shevlin, 2001). A tolerance of 0 indicates that the dependent variable is completely predictable from the independent variable, whereas a tolerance of 1 indicates the dependent variable being completely uncorrelated with the independent variable. The VIF (= 1/tolerance) refers to the amount of the standard error of the dependent variable being increased, that is the increase in standard error is equal to the square root of the VIF (Miles & Shevlin, 2001). Tolerances below .10 and VIFs above 10 indicate serious collinearity and the independent variable being redundant (Kline, 2005). Appendix F presents the results. The analyses revealed that tolerances were all above .10 and the variance inflation factor (VIF) did not exceed 10. So, although several variables may be highly correlated, each variable adds unique information and none of the variables is redundant.

Table 13

Means, standard deviations, and correlations

		T1		T2		1	2	3	4	5	6	7	8	9	10	11	12	13
		M	SD	M	SD													
1	Team leadership	3.47	.58	3.42	.63		.84**	.48**	.50**	.52**	.60**	.53**	.64**	.41**	.49**	.43**	.22**	.22*
2	Team briefing	3.77	.57	3.78	.61	.83**		.48**	.52**	.50**	.62**	.49**	.66**	.45**	.48**	.39**	.18**	.18
3	Team orientation	3.84	.42	3.76	.48	.48**	.40**		.67**	.84**	.82**	.88**	.71**	.63**	.57**	.61**	.38**	.20
4	Mutual performance monitoring	3.73	.42	3.70	.46	.48**	.47**	.75**		.70**	.77**	.59**	.64**	.68**	.52**	.38**	.20**	.06
5	Backup behavior	3.86	.42	3.79	.48	.48**	.47**	.82**	.73**		.82**	.82**	.68**	.65**	.62**	.54**	.35**	.21
6	Adaptability	3.88	.41	3.84	.47	.64**	.65**	.78**	.76**	.78**		.78**	.81**	.73**	.61**	.57**	.34**	.29**
7	Mutual trust	3.81	.41	3.79	.49	.48**	.43**	.85**	.67**	.74**	.75**		.68**	.53**	.56**	.63**	.43**	.26*
8	Shared mental models	3.79	.41	3.87	.43	.64**	.62**	.62**	.70**	.68**	.79**	.63**		.70**	.52**	.49**	.32**	.31**
9	Closed-loop communication	3.98	.42	3.94	.43	.41**	.39**	.63**	.62**	.64**	.68**	.56**	.52**		.46**	.34**	.25**	.09
10	Team output	3.91	.30	3.95	.33	.41**	.39**	.58**	.56**	.58**	.62**	.57**	.51**	.38**		.53**	.31**	.29**
11	Cohesion	3.75	.32	3.71	.41	.41**	.26**	.60**	.49**	.53**	.51**	.61**	.47**	.35**	.58**		.64**	.34**
12	Respect	3.86	.27	3.78	.32	.25**	.27**	.51**	.44**	.51**	.48**	.48**	.42**	.38**	.50**	.50**		.27*
13	Platoon level rating of team effectiveness	3.96	.50	4.06	.51	.14	.14	.15	.15	.18	.32**	.22*	.20*	.20*	.19*	.13	.07	

Note. *Correlations below the diagonal are Time 1 correlations; correlations above the diagonal are Time 2 correlations. Significance levels: ** p < .01; * p < .05.*

5.3.2 *Hypotheses tests*

Model 1

Following the procedure just outlined, first the fit of model 1 was analyzed, when using sample A and B. The results of this analysis are presented in Table 14. In both samples, model 1 fitted the data reasonably well since the CFI and SRMR indicated good fit. However, the RMSEA indicated poor fit, and an acceptable value was not included within the 90% confidence interval.

Model 2

Next, the fit of model 2 was assessed. Again, the CFI and SRMR indicated good fit, whereas the RMSEA indicated poor fit and an acceptable value was not within the 90% confidence interval. Model 2 appeared to have an overall better fit than model 1 since in both samples the value for the χ^2 was significantly lower for model 2 as compared to the χ^2 value for model 1.

Table 14

Results for tests of model fit and significance of difference between the fit of two models

Model	χ^2	df	*p*	CFI	RMSEA	RMSEA 90% CI	SRMR	$\Delta\ \chi^2$	Δ df	*p*
					Sample A					
1	165.757	36	.000	.936	.132	.112 - .153	.069			
2	126.554	33	.000	.954	.117	.096 - .139	.060	-39.203	3	.000
3	131.173	36	.000	.953	.113	.093 - .134	.061	4.619	3	.202
4	103.563	35	.000	.966	.098	.076 - .120	.056	-27.610	1	.000
5	87.139	34	.000	.974	.087	.065 - .110	.051	-16.424	1	.000
					Sample B					
1	200.072	36	.000	.932	.139	.121 - .158	.054			
2	149.377	33	.000	.952	.122	.103 - .142	.046	-50.695	3	.000
3	152.398	36	.000	.952	.117	.098 - .137	.048	3.021	3	.389
4	139.934	35	.000	.957	.113	.094 - .133	.044	-12.464	1	.000
5	107.686	34	.000	.970	.096	.076 - .116	.041	-32.248	1	.000

Note. *CI = confidence interval. Model 1 tests hypothesis 1 through 15 and hypotheses 22 through 24. Model 2 tests hypotheses 1 through 24. Model 3 tests model 2 without hypotheses 5, 6, 7, and 19. Model 4 tests model 3 with a correlation added between the unexplained variances of cohesion and respect. Model 5 tests model 4 with a negative correlation added between the unexplained variances of backup behavior and adaptability.*

In model 2, several paths appeared to be non significant. Table 15 presents these paths for samples A and B. In sample A, five paths appeared to be non significant. In sample B, five paths appeared to be non significant. The four paths that appeared to be non significant in both samples were removed from model 2, leading to a more parsimonious model 3.

Table 15

Overview of non significant paths in models for sample A and B

Hypothesis	Path	Sample A	Sample B	Remarks
	Model 2			
5	Mutual trust→mutual performance monitoring	ns	ns	Removed in model 3
6	Team leadership→mutual performance monitoring	ns	ns	Removed in model 3
7	Team leadership→backup behaviour	ns	ns	Removed in model 3
11	Shared mental models→backup behaviour	ns	*p* < .05	-
14	Closed-loop communication→backup behaviour	*p* < .00	ns	-
19	Team leadership→team orientation	ns	ns	Removed in model 3
	Model 3			
11	Shared mental models→backup behavior	ns	*p* < .05	-
14	Closed-loop communication→backup behavior	*p* < .00	ns	-

Note. *ns = not significant.*

Model 3

Consequently, the fit of model 3 was assessed. This model fitted the data reasonably well (see Table 14). In both samples, the values for the CFI and SRMR indicated good fit. However, the RMSEA indicated poor fit in both samples and an acceptable value did not lie within the confidence interval. The overall fit of model 3 did not change significantly as compared to the overall fit of model 2 (see Table 14). So, both models have identical fit whereas the more parsimonious model 3, as compared to model 2, had not been oversimplified by removing the four paths from model 2.

In model 3, one path appeared to be non significant in sample A. This path appeared to be significant in sample B, whereas one other path in that sample was non significant (see Table 15). Since no path appeared to be non significant in both samples, no more paths were removed.

The overall fit of model 3 remained reasonable. Therefore it was analyzed whether the fit of the model could be improved by adding a path or a correlation to the model. Based on the results of the analysis of model 3 with sample A, it appeared that adding a correlation between the unexplained variances of cohesion and respect, would lead to a significant improvement in overall model fit. This improvement was confirmed by the analyses of model 3 with sample B.

Model 4

The overall fit of model 4 (i.e., model 3 with the correlation added) improved significantly (see Table 14), and CFI and SRMR indicated good fit. The values for the RMSEA neared reasonable fit for the model analyzed with sample A, with a value indicating a reasonable fit within the 90% confidence interval.

For the model, analyzed with sample B, the value for the RMSEA remained below the threshold for reasonable approximation.

Again it was analyzed whether the fit of the model could be improved since the overall fit of model 4 remained reasonable. The results of the analysis of model 4 with sample A, indicated that adding a negative correlation between the unexplained variances of backup behaviour and adaptability, would lead to a significant improvement in overall model fit. The analyses of model 4 with sample B confirmed this improvement.

Model 5

Consequently, the fit of model 5 (i.e., model 4 with the negative correlation added) was assessed. The overall fit improved significantly (see Table 14). Both the CFI and SRMR indicated good fit, whereas the values for the RMSEA neared reasonable fit for the model analyzed with sample A and B, with a value indicating a reasonable fit within the 90% confidence interval for both samples.

More paths or correlations were not added since this would make to the model more complex, without improving the RMSEA or the overall fit of the model.

Analyzing the model with the combined A and B sample

Next, the fit of model 5 was analyzed using the total sample (i.e., the combined A and B sample, $N = 444$). This model reached acceptable fit (χ^2 [34] = 121.594, $p = .000$; CFI = .980; RMSEA = .076 [.062 - .091]; SRMR = .036). Figure 12 displays the path coefficients, correlations, and the squared multiple correlations of the endogenous variables following this analysis. All paths and correlations are significant.

Analyzing the model with the combined A and B sample with team output rated by platoon level raters

Finally, in the models that were analyzed thus far, team output was based on a self reported measure by the team since a large part of the teams lacked an external (i.e., platoon level) rating of their output. Fortunately, for 204 teams (Time 1 = 114 teams; Time 2 = 90 teams) a platoon level rating of team output was available. The dataset containing these 204 teams was also used to assess the fit of model 5 in which the self reported rating of team output was replaced by the platoon level rating of team output. The fit of this model was reasonable (χ^2 [34] = 107.139, $p = .000$; CFI = .961; RMSEA = .103 [.081 - .125]; SRMR = .045). So, whereas the CFI and SRMR indicated good fit, the RMSEA remained poor with an acceptable value (< .09) within the confidence interval.

In this model, all paths appeared to be significant, except the paths shared mental models → backup behaviour (.02, $p = .74$; hypothesis 11), closed-loop communication → adaptability (.09, $p = .10$; hypothesis 15), and mutual performance monitoring → adaptability (.01, $p = .90$; hypothesis 21). In addition, all correlations appeared to be significant, except the correlation between the unexplained variance of cohesion and respect (.26, $p = .17$). Team output, as rated by platoon level raters, appeared to be a moderate indicator of team effectiveness (.29, $p = .00$).[30]

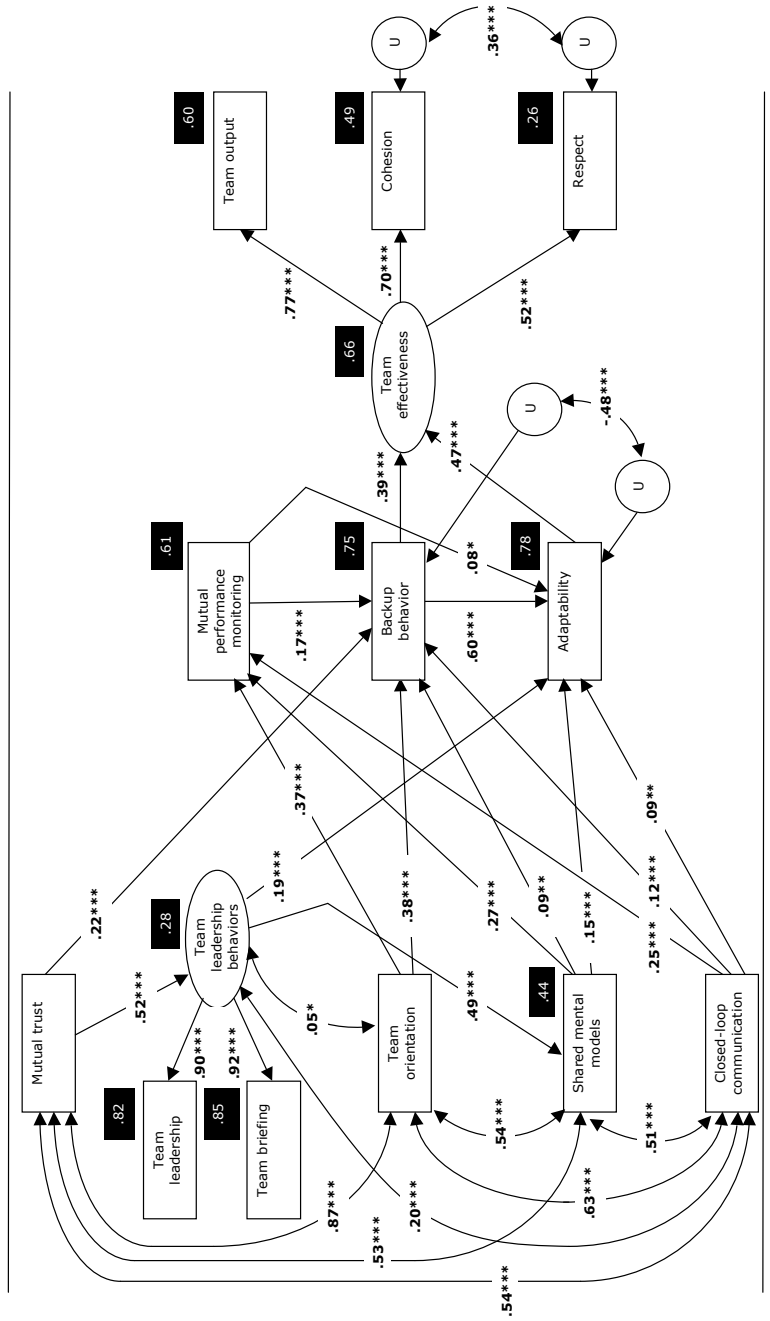

Figure 12: *Path coefficients, correlations, and squared multiple correlations. Significance levels: *** p < .001 ** p < .01; * p < .05. Values in black boxes represent squared multiple correlations. U = unexplained variance.*

[30] Following Cohen (1988), a correlation or effect <.10 will be labeled "weak", around .30 "moderate", and >= .50 "strong".

5.3.3 Summary of the results

Table 16 presents the support for the hypothesized effects, based on the analyses with the self-rated measures of team output. In total, twenty hypotheses were supported. That is, the hypotheses were supported based on the analyses of model 5 with the data from samples A (N = 207) and B (N = 237), and the combined A and B sample (N = 444).

Not supported were the following four hypothesized effects: mutual trust → mutual performance monitoring (hypothesis 5), team leadership behaviors → mutual performance monitoring (hypothesis 6), team leadership behaviors → backup behavior (hypothesis 7), and team leadership behaviors → team orientation (hypothesis 19).

Figure 12 shows that the exogenous variables mutual trust, team orientation, shared mental models, and closed loop communication were strongly interrelated. From that, a moderate to strong path can be shown from team orientation to backup behavior and a strong path from backup behavior to adaptability. Both backup behavior and adaptability had a moderate to strong effect on team effectiveness. Another moderate to strong path can be shown from team orientation to mutually performance monitoring. A strong path can be shown from mutual trust to team leadership behaviors, and a moderate to strong path from team leadership behaviors to shared mental models. Team leadership and team briefing were strong indicators of team leadership behaviors whereas team output, cohesion, and respect were strong indicators of team effectiveness. The other relations in the model were weak to moderate, or weak. The unexplained variances of cohesion and respect were positively correlated, whereas the unexplained variances of backup behavior and adaptability were negatively correlated. The model explained 66% of the variance in team effectiveness.

Table 16
Results for hypothesis tests

Hypothesis		Result
1	Adaptability → team effectiveness	Supported
2	Backup behaviour → team effectiveness	Supported
3	Backup behaviour → adaptability	Supported
4	Mutual performance monitoring → backup behavior	Supported
5	Mutual trust → mutual performance monitoring	Not supported
6	Team leadership behaviors → mutual performance monitoring	Not supported
7	Team leadership behaviors → backup behavior	Not supported
8	Team orientation → mutual performance monitoring	Supported
9	Team orientation → backup behavior	Supported
10	Shared mental models → mutual performance monitoring	Supported
11	Shared mental models → backup behavior	Supported
12	Shared mental models → adaptability	Supported
13	Closed loop communication → mutual performance monitoring	Supported
14	Closed loop communication → backup behavior	Supported
15	Closed loop communication → adaptability	Supported
16	Mutual trust → backup behavior	Supported
17	Mutual trust → team leadership behaviors	Supported
18	Team leadership behaviors → shared mental models	Supported
19	Team leadership behaviors → team orientation	Not supported
20	Team leadership behaviors → adaptability	Supported
21	Mutual performance monitoring → adaptability	Supported
22	Team effectiveness → team output	Supported
23	Team effectiveness → cohesion	Supported
24	Team effectiveness → respect	Supported

5.4 Discussion

The purpose of this chapter was to determine how the teamwork variables were related to each other and to team effectiveness. In general, the findings lead to several conclusions.

First, teamwork consists of the interplay of team leadership behaviors, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental models, and closed-loop communication among team members. This interplay is captured in 15 relations between these teamwork KSAs. Together, teamwork affects the team's output, the team's viability, and the fulfillment of team member's needs, in short, the team's effectiveness.

Second, it can be concluded that the core of the model is built on four sets of relationships. The strongest and most consistent paths run from (1) team orientation to backup behavior and (2) from that to adaptability. The belief in the importance of team goals over individual member's goals is very important to the anticipation of each other's needs and the shifting of workload among team members (backup behavior). Furthermore, this anticipation and support create a reallocation of team resources. The strength and consistency of these paths in the model can be explained from the fact that these military teams are more successful when they are fully aware that they are very much dependent upon each other in uncertain and dangerous conditions where anything may happen. In these teams, this attitudinal variable team orientation is an important part of teamwork. Moreover, the moderate to strong paths from (3) backup behavior and (4) adaptability to team effectiveness make sure that the teamwork variables ultimately have an effect on effectiveness. This part of the model is fully supporting the model of Salas et al. (2005).

Third, mutual performance monitoring is moderately to strongly affected by team orientation, and weakly to moderately affected by shared mental models and closed-loop communication. It means that monitoring each other's performance results from the belief in the importance of team goals, from an organized knowledge structure, and from the adequate exchange of information within the team. These relations emphasize the importance of a common understanding in these kinds of teams for the amount of monitoring that takes place. Although Salas et al. (2005) regarded mutual trust as an important prerequisite for mutual performance monitoring to occur, there is no effect from mutual trust on mutual performance monitoring. Also, the team leader plays no role in the process of monitoring within teams. The role of team leadership, however, will be elaborated on later.

Although mutual performance monitoring is affected by a number of variables, there is a modest effect on team effectiveness because of the modest link between mutual performance monitoring and back-up behavior. The following reason may account for that. Team members may monitor each other's performance to a large extent, but do not have to draw the conclusion that it is important or necessary to backup each other. More monitoring does not have to lead to the conclusion that more help is needed. However, when help is needed, team members are more inclined to help each other as a direct result of a stronger team orientation.

Fourth, mutual trust weakly to moderately affects backup behavior. This path supports Porter et al.'s (2003) finding that for team members to provide backup to team mates, these team members must acknowledge the implicit or explicit request for help to be legitimate. So, when team members trust that they can depend on every team member to execute these tasks with full effort and that they can

trust each other's skills and knowledge, they are more willing to provide for backup when it is needed. Also interestingly is the strong effect of mutual trust on team leadership behaviors. So, in a climate of mutual trust, the team leader's actions appear to full advantage (see e.g., Vogelaar & Kuipers, 1997).

Fifth, in this study, team leadership seems to have a small effect on the teams' functioning. Of the four hypothesized paths, only one appeared to be significant. The moderate to strong path team leadership behaviors to shared mental models indicates that the team leader plays an important role in updating the shared knowledge among team members on how roles and tasks are assigned within the team. On the other hand, a moderate effect of team leadership behaviors to adaptability was added to the model. The non significant effects of team leadership behaviors on mutual performance monitoring, backup behavior, and team orientation, and the new effect of team leadership behaviors on adaptability will be addressed now.

Several substitutes for leadership (Kerr & Jermier, 1978; Koene, Vogelaar, & Soeters, 2002; Podsakoff, MacKenzie, & Bommer, 1996) and shared or distributed leadership (Bligh et al., 2006; Gronn, 2002; Hiller et al., 2006; Pearce, Conger, & Locke, 2008) may account for the low impact of leadership in this study. The substitutes for leadership make leader behaviors unnecessary or redundant (Yukl, 2006; Zaccaro & Klimoski, 2002). Among the substitutes that might account for unnecessary or redundant leadership behaviors are the presence of experienced and highly trained team members, role clarity, effective performance strategies, backup behavior among team members, and cohesiveness among team members (Yukl, 2006). For example, if team members master their task and teamwork skills and drills and adequately display these skills and drills in pursuing team goals, there is less need, if any, for team leaders to direct or correct team members.

Shared or distributed leadership assumes that leadership functions can be collectively enacted upon. It is a dynamic, interactive influence process among team members so they lead each other in the pursuit of team goals (Avolio, Sivasubramaniam, Murry, Jung, & Garger, 2003).The influence process can be both lateral (i.e., peer to peer) and hierarchical (i.e., upward or downward; Avolio et al., 2003). The idea that leadership functions can be shared among team members is underscored by Smith-Jentsch, Johnston, et al. (1998) and Smith-Jentsch, Zeisig, et al. (1998) who regard "team initiative and team leadership" as one of the four teamwork dimensions (besides information exchange, communication, and supporting behavior). According to this teamwork dimension, anyone on the team can demonstrate initiative or leadership, providing guidance or suggestions to team members, and stating clear and appropriate priorities (Smith-Jentsch, Zeisig et al., 1998). Since this 'team initiative' is advocated in the Royal Netherlands Army (Vogelaar & Kramer, 1997, 2004), it is suggested that aspects as providing each other feedback, giving each other directions, and helping each other are expressions of shared leadership, making formal top-down leadership behaviors in teams more or less redundant.

Although not expected in advance, team leadership behaviors have a moderate effect on the team's adaptability. It appears that when the team needs to adjust to changing internal or external circumstances, this is enabled by team leadership behaviors in that the team leader clearly sets new goals, assigns new tasks or reassigns tasks, and confirms or establishes norms and rules of conduct. So, when the team functions as expected, team leadership behaviors remain at the background or can be shared among team members, whereas team leadership behaviors are expressed more pronounced top-down when teams need to adjust due to the circumstances at hand.

Finally, a correlation between the unexplained variances of backup behavior and adaptability, and between the unexplained variances of cohesion and respect had to be added to the model to reach adequate fit. A correlation between the unexplained variances of two variables may indicate that the corresponding variables share at least one common omitted cause (Kelloway, 1995; Kline, 2005).

As is mentioned in Chapters 2 and 4, the teams that were studied, were task and outcome interdependent. Nevertheless, the teams may vary to the extent that team members have specialized knowledge and skills for their taskwork. Therefore, within specific teams, team members may have been too specialized to backup each other fully. That is why it is suggested that the omitted cause in the model may be something like *perceived specialized skill in one's own task*. The amount of specialized skill that each team member in a military team has, may improve requisite variety, and with that adaptability. However, these specialized skills make it less possible to backup each other in the performance of their tasks. This suggests that a measure of skill specialization or – the opposite – generalizability of skills should be added to the model. In this study, no measure was included that was able to provide information on skill specialization or generalizability of skills.

In previous chapters, it was mentioned that military teams may operate under demanding circumstances. Moreover, team members work and live together intensely for months. Teams may be like families in which team members talk with each other about ordinary things and work topics, take care of each other, and support each other, especially when times get tough. Being considerate towards each other, and/or providing for social support, may enhance team member's feeling of being respected and it may strengthen social ties (Griffith, 2002). Therefore, it is suggested that the omitted cause in the model may be *consideration* and/or *social support*.

In conclusion, in this chapter the relations between teamwork KSAs and between teamwork KSAs and team effectiveness were analyzed in a field study using military teams. Despite several shortcomings in the study, which will be elaborated in Chapter 7, empirical support was provided for the validity of most of the hypothesized relations between the teamwork variables and between teamwork and team effectiveness. Still, several relations between teamwork variables need to be further investigated, for example the relations in the model that were not significant and the relations that were added to the model. Therefore, more research is needed. The results of this study need replication, especially in different contexts with different samples of respondents, and with a wide variety of teams before definite conclusions can be drawn about the relations among the teamwork variables in the model. Nevertheless, based on the results several practical implications can be derived, which will also be elaborated in Chapter 7.

6.

The development of teamwork over time

6. The development of teamwork over time

6.1 Introduction

Military teams perform under difficult circumstances while being deployed to Peace Support Operations. These circumstances demand that team members cooperate, coordinate and communicate intensely with each other in order to successfully accomplish their team's missions. Military teams are usually well prepared for their tasks. Team members receive ample individual training in their taskwork and teams themselves are trained extensively before being deployed to the area of operations. However, since military teams are mostly deployed for longer periods of time, many things may happen that affect team members and the way team members work together within teams. Even the passing of time itself may be of influence.

Although research on teamwork has been abundant in recent years, the literature reveals little on how teamwork develops over time and what factors affect that development. Therefore, this chapter addresses the issue of development of teamwork over time in military teams. The following research question was formulated. *'How does teamwork develop over time and what factors are of influence on that development?'* The answer to this question may provide those who lead and train military teams, or who are team members themselves, with insights on how to sustain effective teamwork and how to enhance teamwork over time, even when situations in which the team performs are difficult, such as in Peace Support Operations.

In Chapter 2, several potential antecedents of change in teamwork over time are described. These antecedents are potency, vertical cohesion, inter-team-cooperation, and satisfaction with job characteristics. In addition, whether or not a team is (to be) deployed into high risk circumstances may be a factor that affects the development of teamwork. The hypothesized relations among these constructs were described in Chapter 3. Figure 13 summarizes these hypotheses.

Noteworthy in Figure 13 is that vertical cohesion appears twice. In Chapter 4 it was argued that both vertical cohesion with the team leader and vertical cohesion with the platoon leader may affect the interpersonal climate and trust between leaders and followers and in that, may affect teamwork. Therefore, the initial hypothesis 26 (Δ vertical cohesion → Δ teamwork) is specified into hypothesis 26a which addresses the effect of vertical cohesion with the team leader on teamwork, and hypothesis 26b which addresses the effect of vertical cohesion with the platoon leader on teamwork.

Another noteworthy aspect in Figure 13 is that the test for discriminant validity of the constructs in Chapter 4 revealed that satisfaction with job characteristics subsumed two constructs (i.e., challenging work and feedback). Therefore, the initial hypothesis 28 (Δ job characteristics → Δ teamwork) is specified as hypothesis 28a (Δ challenging work → Δ teamwork) and hypothesis 28b (Δ feedback → Δ teamwork).

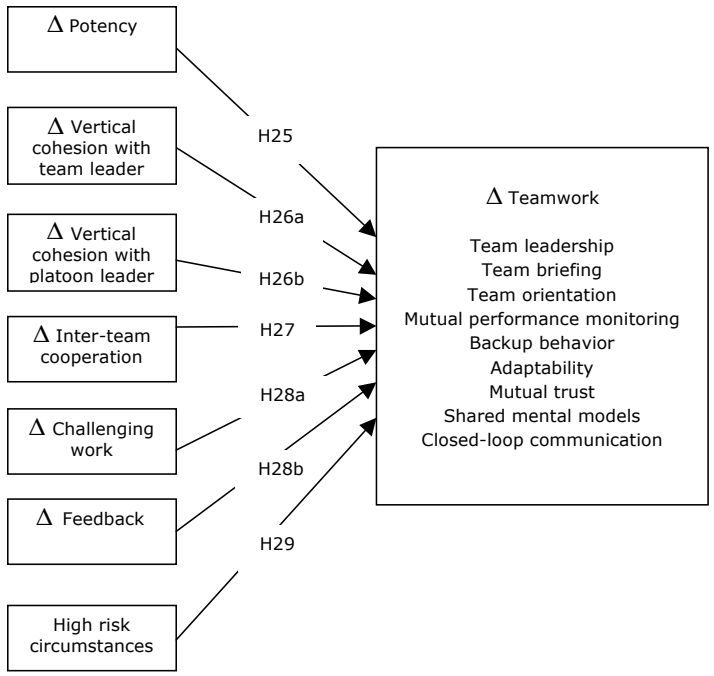

Figure 13: *Hypothesized effects of change in potency, vertical cohesion, inter-team cooperation, challenging work, feedback, and high risk circumstances on change in teamwork. H = hypothesis.*

6.2 Method

6.2.1 Sample and procedure of data collection

The population was described in section 4.2. From that population, teams were sampled that were represented by at least two respondents and each respondent took part at both measurement moments. Additional team members that participated at one measurement moment only, were left out of the analyses. In total, data from 144 military teams were used in this study. These teams were represented by, on average, 4.1 military personnel (*SD* = 1.9).

Time 1 was two to four months before the end of the training period and deployment to the mission. Time 2 was at mid-deployment when the teams were deployed for two months to Afghanistan or three months to Bosnia-Herzegovina. From the 144 teams, 104 (72.2%) performed their tasks in high risk circumstances regularly. That is, these teams were deployed to Afghanistan and they left the Forward Operating Base regularly or often to perform their tasks in dangerous and demanding circumstances. Teams that were deployed to Bosnia-Herzegovina and teams that were deployed to Afghanistan, but performed their tasks on the Forward Operating Base (so they were able to work and live mostly in armored containers), were regarded to perform their tasks in (relatively) low risk circumstances.

All measures were self-reported measures at the team level. See Chapter 4 for all details concerning the participating units, the respondents, the questionnaire used, how the study was conducted, and how the variables were aggregated from the individual level to the team level.

6.2.2 Analyses

The central question to be answered in this chapter is how teamwork develops over time, and how that development is influenced. Although the question seems straightforward, "longitudinal relationships can be very complicated" and therefore "different types of analysis should be performed to investigate different aspects of longitudinal relationships" (Twisk, 2007, p. 60). Each type of analysis provides a *specific perspective* on the development of teamwork, and the factors affecting that development.
By combining the results of several analyses, one gets a firm understanding of the development of variables, and the effect over time of predictor variables on the dependent variable (Twisk, 2007).

Descriptives

The means and standard deviations for the variables in this study at both measurement moments were computed. In addition, a distinction was made for teams that operated in high risk circumstances regularly, and for teams that did not. Moreover, it was analyzed whether the means differed for the teams that operated in high risk circumstances regularly, and for teams that did not, at Time 1 and Time 2. Therefore a one-way analysis of variance (ANOVA) was used with the teamwork variables and the antecedents of change as dependent variables, and high risk circumstances as a factor. Next, the correlations between the variables in the study at Time 1 and at Time 2 were computed. For each variable, the correlations between the scores at Time 1 and 2 were also computed.

The development of teamwork and other variables

To test whether teamwork variables changed over time, a factorial repeated-measures analysis of variance (ANOVA) was used. For each teamwork variable it was assessed whether it changed over time (a within-subjects, or repeated-measures effect). Furthermore, it was assessed whether scores on each teamwork variable differed for teams that operated in high risk circumstances regularly or not (a between-subjects, or factor effect). Besides the within-subjects effect of time, and the between-subjects effect of high risk circumstances, it was assessed whether the change over time for the teamwork variables differed for the teams that operated under high risk circumstances, as compared to the teams that did not. That is, an interaction effect of time and high risk circumstances was analyzed. Likewise, for each predictor variable (e.g., potency), a factorial repeated-measures ANOVA was performed to assess the within-subjects effect of time, the between-subjects effect of high risk circumstances, and the interaction effect of time and high risk circumstances.

The effect of several factors on teamwork

The hypotheses (see Figure 13) were tested using regression analyses. In each regression analysis, one of the teamwork variables (i.e., team leadership, team briefing, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental models, and closed-loop communication) was entered as the dependent variable, and potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, and feedback were entered as the predictor variables. Working in high risk circumstances was entered as a control variable.

Each regression analysis was performed six times (i.e. six types of regression analysis). In each type, specific information on the dependent and predictor variables was entered in the analyses, so different perspectives on the relation between the predictor variables and the dependent variable were assessed. In total, fifty-four regression analyses were performed (6 perspectives * 9 dependent variables). The six perspectives will be explained below.

Perspective 1: Cross-sectional analysis on Time 1
The first perspective was a cross-sectional perspective at Time 1. That is, the effects of potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, feedback, at Time 1, on teamwork, at Time 1, were assessed, controlling for high risk circumstances. In this perspective, it is assessed whether teamwork before deployment is affected by factors before deployment.

Perspective 2: Cross-sectional analysis on Time 2
Likewise, the regression analyses were performed with all variables measured at Time 2. So, this cross-sectional perspective on Time 2 assesses whether teamwork at mid-deployment is affected by factors at mid-deployment.

Perspective 3: Time-lag analysis
The third perspective is referred to as a 'time-lag' analysis (see e.g., Twisk, 2007). In a 'time-lag' analysis it is assessed whether the predictor variables at Time 1 have an effect on the dependent variable at Time 2. So, the 'time-lag' analysis assessed whether team scores at the end of the training period (i.e. Time 1) on potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, and feedback had an effect on the team's teamwork scores at mid-deployment (i.e. Time 2), again controlling for high risk circumstances. By using a 'time-lag' analysis, it is possible to assess the extent to which teamwork at mid-deployment is influenced by factors before deployment.

Perspective 4: Long-term exposure analysis
The fourth perspective is referred to as a 'long-term exposure' analysis (see e.g., Twisk, 2007). In this analysis, the long-term effect of predictor variables on the dependent variable on Time 2 is assessed. The long-term effect is the effect of the predictor variable that ranges from Time 1 to Time 2. Therefore, in the analyses, the average scores (i.e. [Time 1 value + Time 2 value]/2) for potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, and feedback were entered as predictors, together with the control variable high risk circumstances, whereas the teamwork scores on Time 2 were entered as dependent variables. By using a 'long-term exposure' analysis, it is possible to assess the extent to which teamwork at mid-deployment is influenced by the effect of the predictor variables that spans several months, ranging from the end of the training period to mid-deployment.

Perspective 5: Change scores analysis
The fifth perspective is referred to as a 'change scores' analysis (see e.g., Twisk, 2007). According to Twisk (2007), this type of analysis is most popular when analyzing longitudinal data. In this analysis, for both the dependent as the predictor variables the change scores were calculated as the difference between the Time 2 and Time 1 scores (i.e. Time 2 score - Time 1 score). Consequently, the change scores for the dependent and predictor variables were entered in the regression analyses together with the control variable high risk circumstances. By using a 'change scores' analysis, it is possible to assess the extent to which the development (i.e. change) of teamwork variables from the end of the training period to mid-deployment is affected by the development of the predictor variables in the same time period, when controlled for working in high risk circumstances.

Controlling for the Time 1 value of the dependent variable
In all analyses described above, the Time 1 value of the dependent variable was also included as a predictor variable. As a result, the effect of the predictor variables on the dependent variable are relative to this 'auto-effect' (the effect on the dependent variable Time 2 by the same variable at Time 1). Including the Time 1 value for the dependent variable as a predictor of the value for the dependent variable on Time 2 is especially important in the analyses with 'change scores'. A typical problem related to analyses using 'change scores' is the phenomenon of regression to the mean (Barnett, Van der Pols, & Dobson, 2005; Bland & Altman, 1994a, 1994b; Twisk, 2007). This regression to the mean "is a statistical phenomenon that can make natural variation in repeated data look like real change. It happens when unusually large or small measurements tend to be followed by measurements that are closer to the mean" (Barnet et al., 2005, p. 215). By including the Time 1 score of the dependent variable as a predictor of the Time 2 score of the predictor variable, the phenomenon of regression to the mean is corrected for (Barnett et al., 2005; Bland & Altman, 1994a, 1994b; Twisk, 2007).

Simple versus sophisticated analyses
Before moving to the final perspective, it should be mentioned that the regression analyses as described above, have in common that they do not include all available information in the analysis (i.e., the Time 1 and 2 scores for each variable that is included in the analysis). In the cross-sectional analyses, only the Time 1 or Time 2 scores are included. Therefore, no development can be assessed in either variable. Figure 14 pictures this situation for the Time 1 variables (Appendix G presents the formula). Likewise, a picture could be drawn for the Time 2 situation albeit that for the dependent variable, the Time 1 score would be included.

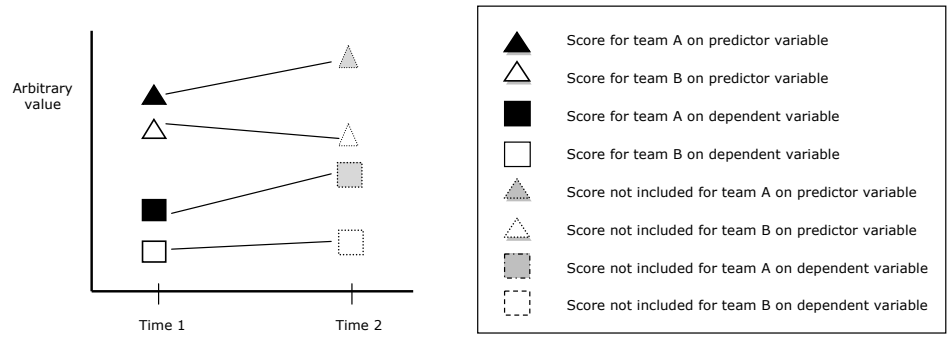

Figure 14: *Graphical presentation of the cross-sectional analysis at Time 1.*

In the 'time-lag' analysis (see Figure 15 and Appendix G), no information is available on the Time 2 scores for the predictor variables. Therefore, this analysis does not take into account whether any development took place in the predictor variables themselves and whether that development affected the development of the teamwork variables.

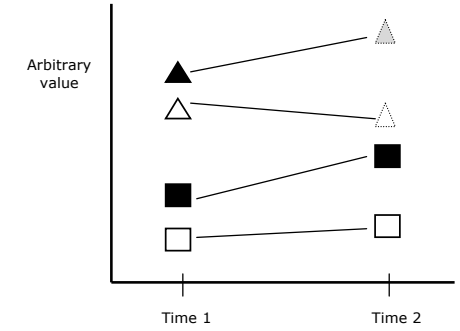

Figure 15: *Graphical presentation of the time-lag analysis. For explanation of the symbols, see the caption to Figure 14.*

In the 'long-term exposure' analyses (see Figure 16 and Appendix G), no information is available on the Time 1 and 2 scores for the predictor variables. As a consequence, the analysis does not take into account whether the long-term effect of the predictor variable deteriorated or improved over time, or remained the same.

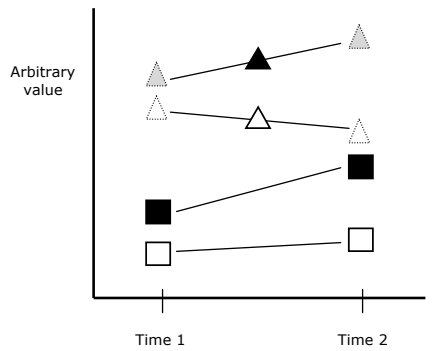

Figure 16: *Graphical presentation of the long-term exposure analysis. For explanation of the symbols, see the caption to Figure 14.*

In the 'change scores' analysis (see Figure 17 and Appendix G), no information is available on the Time 1 and 2 scores for the predictor variables or for the teamwork variables. So, this analysis does not take into account whether the amount of change of the predictor variable can be related to the initial (i.e. Time 1) value of the predictor variable.

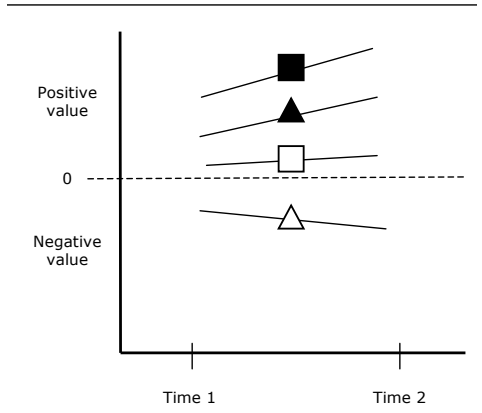

Figure 17: *Graphical presentation of the change scores analysis. In this Figure, the Time 1 score for the dependent variable cannot be visualized since the values in the Figure are not the raw scores.*

So, neither of the analyses mentioned above includes all available information, and therefore, no complete picture on the relation between the development of the predictor and dependent variables can be obtained. The advantage of using these analyses as described above, however, is that they are performed by conventional linear regression analysis. As a consequence, the results of the analyses are easy to interpret. Nevertheless, Twisk (2007) labeled these three types of analysis as 'simple' and 'traditional' analyses.

Perspective 6: Multi-level analysis

The final type of analysis, which Twisk (2007) labeled 'sophisticated', is a multi-level analysis. This analysis takes all available information into account (see Figure 18 and Appendix G). That is, for both the predictor and dependent variables, the Time 1 and 2 values are included in the analysis.
The analysis is a multi-level analysis since the Time 1 and 2 scores are the lowest level in the analysis, whereas the team represents the highest level in which the Time 1 and 2 scores are nested.

A disadvantage of the multi-level analysis, as compared to the analyses mentioned above, is that the regression coefficients that result from the multi-level analysis are more difficult to interpret. In a multi-level analysis which analyzes the longitudinal relation between variables, a regression coefficient B combines a *within-subject* relationship with a *between-subjects* relationship (Twisk, 2007). The interpretation of the regression coefficient B, therefore, is twofold:

> (1) the 'between-subjects' interpretation indicates that a difference between two subjects of 1 unit in [...] predictor variable [X] is associated with a difference of [B] units in the outcome variable Y; (2) the 'within-subject' interpretation indicates that a change within one subject of 1 unit in the predictor variable [X] is associated with a change of [B] units in the outcome variable Y. [...] [T]he 'real' interpretation is a combination of both relationships (Twisk, 2007, p. 88).

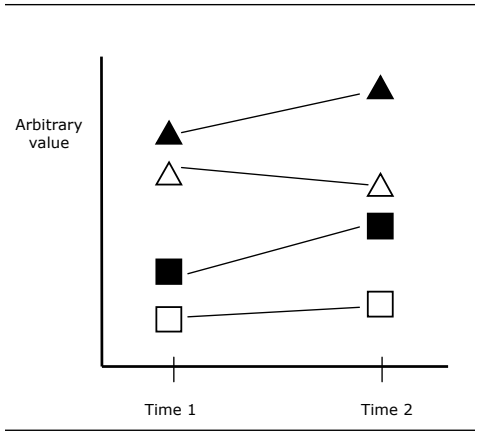

Figure 18: *Graphical presentation of the multi-level analysis. For explanation of the symbols, see the caption to Figure 14.*

The multi-level analyses were performed using SPSS 12 (i.e., the linear mixed models module in SPSS). Therefore, the regular data file had to be restructured into a "stacked data file" (Peugh & Enders, 2005, p. 718). In a "stacked data file", each team has more records, one for each measurement moment. In the stacked data file, a new variable time was created that reflected the timing of measurements (Time 1 with the value '0' and Time 2 with the value '1').

Grand mean centering was performed on each predictor (except time). So, scores on a predictor were deviated around the sample mean (Hox, 2002; Kreft & De Leeuw, 1998). Centering the predictors around the grand mean has the advantage that the intercept is interpretable as the expected score of the dependent variable when all predictors have their mean score, i.e., 'the average team' (see e.g., Hox, 2002).

Consequently, nine multi-level regression analyses were performed. In each analysis, one of the nine teamwork variables was entered as the dependent variable, and potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, feedback, and time were entered as predictors together with high risk circumstances as a control variable.

Each multi-level analysis was performed in two steps for each dependent variable. In the first step, a model was analyzed with only an intercept. In fact, this step calculated the overall mean with its variance. In the second step, the predictors and control variable were entered with all parameters fixed. That is, the intercept and slope were the same for each team.[31] For both steps, the fit of the model was calculated. A significant difference in model fit of the step 2 model as compared to the step 1 model, indicates that the step 2 model fits the data better.[32]

[31] The parameters in the random coefficient analyses were estimated using Maximum Likelihood (ML) estimation since ML estimation is needed when comparing models (Field, 2009).

[32] The fit of the model was calculated by the -2 Log Likelihood (-2LL). The value of -2LL by itself is useless (Twisk, 2007) but the fit of the step 2 model could be compared to the fit of the step 1 model. The difference between both models follows a χ^2 –distribution with a number of degrees of freedom equal to the difference in the number of parameters estimated in both models (Hox, 2002).

Combining the results of the perspectives

The research question is concerned with the effect of the development of antecedents of change in teamwork on the development of teamwork. Since the multi-level analysis is most appropriate to provide an answer to that question, the results from the multi-level analyses will be used to determine whether the hypotheses are supported or not. However, as mentioned earlier, the regression coefficients that derive from the multi-level analyses are difficult to interpret, since these coefficients combine a within-subjects effect with a between-subjects effect. Therefore, the results from the other types of regression analyses will be used, when necessary, to provide background information when interpreting the results from the multilevel analyses. Performing six types of regression analyses with the same predictor variables on the same dependent variable increases the likelihood of Type I errors to occur. That is, the chance increases that an effect will be found when in fact there is no effect. However, since only the multi-level regression analysis will be used to determine whether or not predictor variables have an effect on the dependent variable, the results will not be impaired by inflated error rates.

6.3 Results

6.3.1 Means and standard deviations

Table 17 presents the means and standard deviations for the teamwork variables and the antecedents of change for teamwork. Besides the overall scores, the table presents the scores for teams that operated under high risk circumstances regularly, and for teams that did not (i.e. low risk circumstances). Moreover, Table 17 presents the results for the tests whether the means differed for teams that operated under high risk circumstances regularly, or not, at Time 1 and 2.

Overall, the means for the teamwork variables ranged from 3.56 (team leadership) to 4.03 (closed-loop communication), at Time 1. At Time 2, the scores ranged from 3.50 (team leadership) to 3.96 (closed-loop communication). Since the scores on the teamwork variables and antecedents of change could vary from 1 *(never)* to 5 *(always)*, the results show that, on average, teamwork KSAs are displayed 'regularly' to 'often' within teams, at Time 1 and 2.

For the antecedents of change, the scores ranged from 3.14 (feedback) to 4.02 (vertical cohesion with team leader), at Time 1, and from 3.14 (feedback) to 3.96 (vertical cohesion with team leader), at Time 2. These scores could also vary from 1 *(strongly disagree* or *never)* to 5 *(strongly agree* or *always)*. So, in general, teams experienced themselves as potent entities that had cohesive ties with their team leader and platoon leader, at Time 1 and 2. Likewise, on average, teams cooperated closely with other teams 'regularly' to 'often' and experienced their work as challenging, at Time 1 and 2. Teams, however, were neutral regarding the sufficiency of feedback that was provided, at Time 1 and 2.

Teams that were to operate under high risk circumstances (i.e., Time 1), or operated under high risk circumstances regularly (i.e., Time 2) scored higher on all teamwork KSAs at Time 1 and 2, as compared to teams that did not. However, the differences were not significant for team orientation (Time 1), mutual trust (Time 1), and closed-loop communication (Time 1 and 2).

Likewise, teams that were to operate under high risk circumstances (i.e., Time 1), or operated under high risk circumstances regularly (i.e., Time 2) scored higher on potency and vertical cohesion with the

team leader at Time 1 and 2, as compared to teams that did not. In addition, teams that were to operate under high risk circumstances (i.e., Time 1), or operated under high risk circumstances regularly (i.e., Time 2) scored higher on vertical cohesion with the platoon leader, and inter-team cooperation, at Time 2.

At Time 1, the significant differences between the mean scores for the teams that were to operate under high risk circumstances and the teams that did not, ranged from .17 (mutual performance monitoring) to .51 (team briefing). At Time 2, the significant differences between the mean scores for the teams that operated under high risk circumstances and the teams that did not, ranged from .17 (mutual trust and vertical cohesion with the team leader) to .65 (team briefing). So, teams that were to operate under high risk circumstances (i.e., Time 1), or operated under high risk circumstances regularly (i.e., Time 2), in general, performed better than teams that did not. In the former teams, especially team leadership and team briefing activities were performed more pronounced than in the latter teams.

6.3.2 Correlations

Table 18 presents the correlations between the variables at Time 1 and 2. The correlations between the Time 1 and 2 scores for each variable are also included in Table 18. At Time 1, the correlations between the teamwork KSAs ranged from .20 (between team briefing and mutual trust) to .82 (between team orientation and mutual trust). However, teamwork KSAs are strongly interrelated since most correlations between teamwork variables at Time 1 are strong (i.e., >=.50). At Time 2, the correlations between the teamwork KSAs ranged from .31 (between team leadership and closed-loop communication) to .82 (between team orientation and mutual trust). Again, most teamwork KSAs were strongly interrelated. The correlations between the Time 1 and 2 scores for the teamwork KSAs ranged from .39 (for team orientation) to .59 (for team briefing and adaptability). Thus, a score on a teamwork KSA at Time 1 was moderately to strongly, and positively, related to its Time 2 score.

At Time 1, the significant correlations between the antecedents of change in teamwork and the teamwork KSAs ranged from .16 (between high risk circumstances and backup behavior) to .50 (between potency and mutual trust). However, most of these significant correlations were moderate. At Time 2, the significant correlations ranged from .17 (between high risk circumstances and mutual trust) to .59 (between potency and mutual trust). Again, most significant correlations were moderate.

Table 17

Means and standard deviations for teamwork variables and antecedents of change

	T1						T2						T1		T2	
	All		Low risk		High risk		All		Low risk		High risk		Difference between low and high risk		Difference between low and high risk	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	*F*	*p*
Team leadership	3.56	.60	3.27	.65	3.67	.54	3.50	.62	3.12	.62	3.65	.56	14.19	.00	24.42	.00
Team briefing	3.85	.58	3.48	.67	3.99	.48	3.86	.57	3.39	.61	4.04	.45	26.93	.00	47.67	.00
Team orientation	3.92	.40	3.84	.45	3.95	.38	3.78	.43	3.65	.47	3.83	.41	2.13	.15	5.65	.02
Mutual performance monitoring	3.79	.38	3.67	.48	3.84	.32	3.73	.44	3.58	.44	3.79	.42	6.04	.02	7.35	.01
Backup behavior	3.94	.40	3.83	.48	3.98	.35	3.83	.47	3.67	.56	3.88	.43	3.96	.05	5.83	.02
Adaptability	3.95	.39	3.82	.43	4.00	.36	3.87	.43	3.71	.48	3.93	.39	6.75	.01	8.18	.00
Mutual trust	3.89	.39	3.83	.36	3.92	.39	3.82	.45	3.70	.49	3.87	.43	1.51	.22	4.00	.05
Shared mental models	3.85	.39	3.68	.46	3.92	.34	3.91	.41	3.69	.46	3.99	.35	11.41	.00	17.23	.00
Closed-loop communication	4.03	.37	3.93	.43	4.07	.34	3.96	.41	3.90	.47	3.98	.38	3.64	.06	1.11	.29
Potency	3.86	.31	3.69	.29	3.93	.29	3.92	.38	3.67	.36	4.01	.35	19.53	.00	26.87	.00
Vertical cohesion with team leader	4.02	.42	3.86	.58	4.08	.33	3.96	.40	3.84	.32	4.01	.41	7.70	.01	4.57	.03
Vertical cohesion with platoon leader	3.90	.34	3.89	.34	3.90	.35	3.89	.42	3.72	.41	3.96	.40	.05	.83	9.75	.00
Inter-team cooperation	3.77	.34	3.71	.43	3.80	.30	3.77	.39	3.63	.46	3.82	.34	1.96	.16	7.95	.01
Challenging work	3.94	.33	3.95	.34	3.94	.33	3.83	.42	3.82	.35	3.84	.44	.02	.89	.03	.86
Feedback	3.14	.56	3.06	.60	3.17	.54	3.14	.58	3.05	.58	3.18	.58	1.13	.29	1.55	.22

Table 18 (continued)
Correlations

		1	2	3	4	5	6	7	8	9
1	Team leadership	.55 **	.80 **	.34 **	.40 **	.36 **	.43 **	.40 **	.48 **	.31 **
2	Team briefing	.80 **	.59 **	.37 **	.40 **	.39 **	.49 **	.35 **	.57 **	.32 **
3	Team orientation	.37 **	.28 **	.39 **	.54 **	.79 **	.75 **	.82 **	.63 **	.52 **
4	Mutual performance monitoring	.37 **	.39 **	.68 **	.41 **	.57 **	.62 **	.46 **	.51 **	.49 **
5	Backup behavior	.35 **	.35 **	.76 **	.63 **	.47 **	.78 **	.72 **	.66 **	.52 **
6	Adaptability	.50 **	.53 **	.70 **	.67 **	.70 **	.59 **	.70 **	.76 **	.57 **
7	Mutual trust	.29 **	.20 *	.82 **	.58 **	.63 **	.64 **	.49 **	.61 **	.34 **
8	Shared mental models	.48 **	.49 **	.51 **	.63 **	.57 **	.73 **	.48 **	.50 **	.51 **
9	Closed-loop communication	.41 **	.43 **	.58 **	.50 **	.58 **	.60 **	.46 **	.45 **	.50 **
10	Potency	.39 **	.35 **	.45 **	.33 **	.34 **	.48 **	.50 **	.40 **	.32 **
11	Vertical cohesion with team leader	.47 **	.38 **	.37 **	.29 **	.37 **	.36 **	.36 **	.33 **	.21 *
12	Vertical cohesion with platoon leader	.24 **	.30 **	.25 **	.24 **	.21 *	.29 **	.19 *	.23 **	.26 **
13	Inter-team cooperation	.24 **	.23 **	.37 **	.29 **	.26 **	.38 **	.42 **	.28 **	.28 **
14	Challenging work	.04	-.05	.33 **	.20 *	.27 **	.22 **	.28 **	.25 **	.13
15	Feedback	.18 *	.14	.28 **	.38 **	.28 **	.29 **	.25 **	.29 **	.11
16	High risk situation	.30 **	.40 **	.12	.20 *	.16 *	.21 *	.10	.27 **	.16

(continued)

Table 18 (continued)
Correlations

		10	11	12	13	14	15	16
1	Team leadership	.33 **	.47 **	.41 **	.39 **	.05	.29 **	.38 **
2	Team briefing	.39 **	.44 **	.37 **	.40 **	.03	.29 **	.50 **
3	Team orientation	.58 **	.29 **	.37 **	.56 **	.40 **	.24 **	.20 *
4	Mutual performance monitoring	.26 **	.22 **	.36 **	.29 **	.18 *	.10	.22 **
5	Backup behavior	.42 **	.31 **	.29 **	.47 **	.30 **	.19 *	.20 *
6	Adaptability	.45 **	.34 **	.31 **	.56 **	.42 **	.26 **	.23 **
7	Mutual trust	.59 **	.23 **	.37 **	.51 **	.33 **	.23 **	.17 *
8	Shared mental models	.42 **	.33 **	.40 **	.46 **	.29 *	.28 **	.33 **
9	Closed-loop communication	.29 **	.31 **	.45 **	.38 **	.29 **	.18 *	.09
10	Potency	.48 **	.18 *	.46 **	.51 **	.29 **	.21 *	.40 **
11	Vertical cohesion with team leader	.41 **	.38 **	.45 **	.32 **	.26 **	.24 **	.18 *
12	Vertical cohesion with platoon leader	.26 **	.19 *	.42 **	.37 **	.24 **	.29 **	.26 **
13	Inter-team cooperation	.43 **	.22 *	.25 **	.52 **	.40 **	.38 **	.23 **
14	Challenging work	.30 **	.31 **	.19 *	.04	.52 **	.47 **	.01
15	Feedback	.22 **	.15	.20 *	.16	.28 **	.41 **	.10
16	High risk situation	.35 **	.24 **	.02	.12	-.01	.09	-

Note. *Time 1 correlations are below the – grey-shaded – diagonal, Time 2 correlations are above the diagonal. On the diagonal are the correlations between the Time 1 and 2 scores for each variable.*
Significance levels: ** $p < .01$; * $p < .05$.

6.3.3 The development of teamwork

Table 19 presents the results for the factorial repeated-measures ANOVA for the teamwork KSAs. For team orientation, backup behavior, adaptability, and mutual trust there was a significant effect of time. These teamwork KSAs deteriorated significantly over time. At mid-deployment (Time 2) team members within teams were less oriented towards each other, were less inclined to backup each other, were less inclined to adapt to changing internal and external circumstances, and were less inclined to trust each other, than at the end of the training period (Time 1).

In addition, it appeared that the scores on team leadership, team briefing, team orientation, mutual performance monitoring, backup behavior, adaptability, and shared mental models differed significantly between the teams that operated under high risk circumstances, as compared to the teams that did not. For the former teams, the scores on these teamwork KSAs were significantly higher as compared to teams that operated under low risk circumstances.

Finally, it was assessed whether the change over time for the teamwork variables differed for the teams that operated under high risk circumstances, as compared to the teams that did not. That is, an interaction effect of time and high risk circumstances was analyzed. It appeared that no interaction effect was significant.

Table 19

Results for factorial repeated-measures ANOVA

	Mean square	*F*	*df*	*p*	Partial Eta squared
Team leadership					
time	.39	2.29	1,142	.13	.02
risk	12.49	25.47	1,142	.00	.15
time * risk	.23	1.36	1,142	.25	.01
Team briefing					
time	.02	.15	1,142	.70	.00
risk	19.42	48.48	1,142	.00	.25
time * risk	.22	1.59	1,142	.21	.01
Team orientation					
time	1.37	13.01	1,142	.00	.08
risk	1.27	5.41	1,142	.02	.04
time * risk	.09	.87	1,142	.35	.01
Mutual performance monitoring					
time	.31	3.13	1,142	.08	.02
risk	2.14	9.70	1,142	.00	.06
time * risk	.03	.33	1,142	.57	.00
Backup behavior					
time	.93	8.95	1,142	.00	.06
risk	1.82	6.79	1,142	.01	.05
time * risk	.06	.59	1,142	.45	.00
Adaptability					
time	.47	6.82	1,142	.01	.05
risk	2.37	9.52	1,142	.00	.06
time * risk	.02	.29	1,142	.59	.00
Mutual trust					
time	.44	4.77	1,142	.03	.03
risk	.94	3.64	1,142	.06	.03
time * risk	.09	.99	1,142	.32	.01
Shared mental models					
time	.09	1.12	1,142	.29	.01
risk	4.13	19.58	1,142	.00	.12
time * risk	.06	.73	1,142	.39	.01
Closed-loop communication					
time	.22	2.85	1,142	.09	.02
risk	.64	2.86	1,142	.09	.02
time * risk	.04	.49	1,142	.49	.00

(continued)

Table 19 (continued)
Results for factorial repeated-measures ANOVA

	Mean square	*F*	*df*	*p*	Partial Eta squared
Potency					
time	.22	2.85	1,140	.09	.02
risk	.64	2.86	1,140	.09	.02
time * risk	.04	.49	1,140	.49	.00
Vertical cohesion with the team leader					
time	.05	.46	1,126	.50	.00
risk	2.11	9.50	1,126	.00	.07
time * risk	.05	.49	1,126	.48	.00
Vertical cohesion with the platoon leader					
time	.11	1.45	1,130	.23	.01
risk	.71	3.68	1,130	.06	.03
time * risk	.68	8.74	1,130	.00	.06
Inter-team cooperation					
time	.04	.60	1,142	.44	.00
risk	1.19	6.08	1,142	.02	.04
time * risk	.17	2.64	1,142	.11	.02
Challenging work					
time	.78	11.09	1,140	.00	.07
risk	.00	.00	1,140	.98	.00
time * risk	.00	.04	1,140	.84	.00
Feedback					
time	.00	.00	1,140	.98	.00
risk	.90	1.98	1,140	.16	.01
time * risk	.01	.07	1,140	.80	.00

6.3.4 The development of antecedents of change

Table 19 also presents the results for the factorial repeated-measures ANOVA for the antecedents of change. For challenging work there was a significant effect of time. This implies that this variable changed significantly over time. At mid-deployment (Time 2), team members experienced their work as being less challenging than at the end of the training period (Time 1).

In addition, it appeared that the scores on vertical cohesion with the team leader, and inter-team cooperation differed significantly between the teams that operated under high risk circumstances, as compared to the teams that did not. Team members in the former teams, experienced their team leader as being more considerate and competent than team members in teams that operated under low risk circumstances. Likewise, teams that operated under high risk circumstances, cooperated more intensely with other teams than teams that operated under low risk circumstances.

Finally, the analyses revealed a significant interaction effect of time and high risk circumstances for vertical cohesion with the platoon leader. Whereas team members in teams working in low risk circumstances experienced their platoon leaders becoming less considerate and competent over time, team members in teams working in high risk circumstances experienced their platoon leaders becoming more considerate and competent over time (see Figure 19).

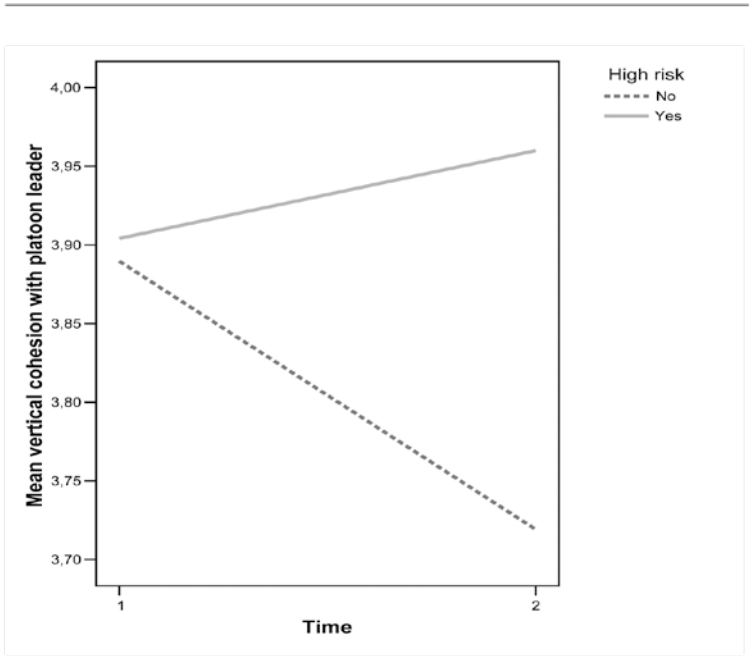

Figure 19: *The interaction effect of time and high risk circumstances for vertical cohesion with the platoon leader.*

6.3.5 The effects of the development of predictor variables on the development of teamwork KSAs

Next, the hypotheses were tested. Appendix H presents the results of the model fit and explained variances for all regression analyses. All cross-sectional, time-lag, long-term exposure, and change-scores regression analyses resulted in significant model fit. All second step multi-level regression analyses resulted in significant improvement in model fit as compared to the first step analyses. On average, the explained variance for the several types of regression analyses were 26% (cross-sectional at Time 1), 48% (cross-sectional at Time 2), 31% (time-lag), 42% (long-term exposure), 37% (change-scores), and 33% (multi-level).

Appendix I presents the regression coefficients and significance levels of these coefficients for all regression analyses. Table 20 summarizes these results. In this table, for each predictor variable and each type of regression analysis, a significant (i.e., p =< .05) positive effect on the dependent variable is visualized by a "+", whereas a significant negative effect of the predictor variable on the dependent variable is visualized by a "-".

As mentioned earlier, the results from the multi-level analyses will be used to determine whether the hypotheses are supported or not. The results from the other types of regression analyses will be used, when necessary, to provide background information when interpreting the results from the multilevel analyses.

Team leadership

Team leadership was positively affected by vertical cohesion with the team leader, inter-team cooperation, and feedback. In addition, teams in high risk circumstances experienced more team leadership than teams in low risk circumstances. Team leadership, however, was negatively affected by challenging work.

The effect of vertical cohesion on team leadership was also present in both cross-sectional analyses. In these analyses, the effect for vertical cohesion with the team leader was substantive. High risk circumstances had a moderate effect in the cross-sectional analysis at Time 2. So, a part of the multi-level effect for vertical cohesion, and to a lesser extent high risk circumstances, must be contributed to the between-subject effects (i.e., differences between teams).

Challenging work had an effect on team leadership according to the cross-sectional analysis at Time 2 and the long-term exposure analysis. So, the effect of challenging work on team leadership may be mainly caused by the differences between teams (i.e., a between-subjects effects) at Time 2. This applies to a lesser extent for the effect of feedback on team leadership.

Table 20

Summary of results for regression analyses with teamwork variables as dependent variables

Predictor variables and type of analysis \ Dependent variable	Team leadership	Team brieifng	Team orientation	Mutual performance monitoring	Backup behavior	Adaptability	Mutual trust	Shared mental models	Closed-loop communication
Dependent variable at Time 1									
cross-sectional at time 2	+	+	+	+	+	+	+	+	+
time-lag	+	+	+	+	+	+	+	+	+
long-term exposure	+	+		+	+	+	+	+	+
change-scores	—	—	—	—	—	—	—	—	—
Potency									
cross-sectional at time 1			+	+		+	+		
cross-sectional at time 2			+		+		+		
time -lag			+						
long-term exposure			+		+		+		
change-scores			+	+	+	+	+	+	
multi-level			+	+	+	+	+	+	
Vertical cohesion with team leader									
cross-sectional at time 1	+	+			+				
cross-sectional at time 2	+	+							
time -lag		+							
long-term exposure	+	+							
change-scores	+								
multi-level	+	+	+		+	+	+	+	
Vertical cohesion with platoon leader									
cross-sectional at time 1		+							
cross-sectional at time 2				+					+
time -lag									
long-term exposure				+				+	+
change-scores				+					+
multi-level		+		+				+	+
Inter-team cooperation									
cross-sectional at time 1							+		
cross-sectional at time 2			+		+	+	+	+	
time -lag			+				+		
long-term exposure			+			+	+	+	
change-scores	+	+	+		+	+	+	+	+
multi-level	+	+	+		+	+	+	+	+

(continued)

Table 20 (continued)

Summary of results for regression analyses with teamwork variables as dependent variables

Predictor variables and type of analysis	Team leadership	Team briefng	Team orientation	Mutual performance monitoring	Backup behavior	Adaptability	Mutual trust	Shared mental models	Closed-loop communication
Dependent variable									
Challenging work									
cross-sectional at time 1			+						
cross-sectional at time 2	–	–							
time -lag									
long-term exposure	–	–							+
change-scores									+
multi-level	–	–	+			+			
Feedback									
cross-sectional at time 1				+	+				
cross-sectional at time 2				–					
time -lag									
long-term exposure	+	+							
change-scores									
multi-level	+	+						+	
High risk circumstances									
cross-sectional at time 1		+							
cross-sectional at time 2	+	+							
time -lag	+	+		+				+	
long-term exposure	+	+		+				+	
change-scores	+	+						+	
multi-level	+	+		+				+	
Time									
multi-level			–		–	–	–		

Note. *A "+" indicates a significant (i.e., $p < .05$) positive effect from the predictor variable on the dependent variable. A "-" indicates a significant negative effect from the predictor on the dependent variable.*

The effect of inter-team cooperation on team leadership appeared to be mainly caused by changes over time in both inter-team cooperation and team leadership (see the change-scores analysis).

Finally, challenging work had a negative effect on team leadership. Interestingly, challenging work had a positive, albeit non significant correlation with team leadership at Time 1 and 2 (see Table 18). This finding implies a suppressor effect (see e.g., Conger & Jackson, 1970; Hennard, 1998) of challenging work on other variables in the regression equation. So, in teams with team members experiencing more challenging work over time, team leadership activities, such as motivating, correcting, and directing team members diminish. Conversely, in teams in which team members experience less opportunities to show their worth, to take initiative, and responsibilities, over time, team leaders direct, correct, and motivate their team members more.

Team briefing

Team briefing was positively affected by vertical cohesion with the team leader and vertical cohesion with the platoon leader. Inter-team cooperation and feedback also positively affected team briefing. Teams in high risk circumstances experienced more team briefing activities than teams in low risk circumstances. Like with team leadership, challenging work had a negative effect on team briefing. The pattern of effects with the significant predictors of team briefing was comparable with the effects of predictors of team leadership.

Team orientation

Potency, vertical cohesion with the team leader, inter-team cooperation, and challenging work positively affected team orientation. In both cross-sectional analyses, the effect of potency on team orientation was substantive. So, a part of the multi-level effect for potency can be explained by the between-subject effects (i.e., differences between teams). The effect of inter-team cooperation appeared to be mainly caused by changes over time in both inter-team cooperation and team orientation (see the change-scores analysis), and its effect on Time 2. The latter may imply a between-subjects effect on Time 2.

Mutual performance monitoring

Mutual performance monitoring was affected by potency and vertical cohesion with the team leader. There was also an effect of high risk circumstances on mutual performance monitoring. Both for potency and vertical cohesion the analyses revealed a between-subjects effect on mutual performance monitoring, albeit this effect appeared at Time 1 for potency, and at Time 2 for vertical cohesion with the platoon leader. Both potency and vertical cohesion with the team leader also had a within-subjects, or longitudinal effect, as can be shown by the change-scores analysis.

Backup behavior

Potency, vertical cohesion with the team leader, and inter-team cooperation affected backup behavior. Both potency and inter-team cooperation combined a longitudinal effect with a between-subject effect at Time 2. The effect of vertical cohesion with the team leader appeared to be influenced by a between-subjects effect at Time 1.

Adaptability

Adaptability was affected by potency, vertical cohesion with the team leader, inter-team cooperation, and challenging work. Potency combined a longitudinal effect with a between-subjects effect at Time 1. Inter-team cooperation appeared to combine a longitudinal effect with a between-subjects effect at Time 1 and 2.

Mutual trust

Potency, vertical cohesion with the team leader, and inter-team cooperation affected mutual trust. Both potency and inter-team cooperation combined a longitudinal effect with a between-subjects effect at Time 1 and 2.

Shared mental models

Shared mental models was affected by potency, vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, and feedback. There was also an effect of

high risk circumstances on shared mental models. The effect of potency appeared to be caused by a combination of between-subjects effects at Time 1 and 2, and a longitudinal effect. For vertical cohesion, the effect is mainly due to a between-subject effect at Time 2. This also applied for inter-team cooperation, however, for this variable a longitudinal effect could also be noticed.

Closed-loop communication
Vertical cohesion with the platoon leader, and inter-team cooperation affected closed-loop communication. The effect of vertical cohesion with the platoon leader combined both a between-subjects effect at Time 1 and 2, as a within-subjects effect. Inter-team cooperation combined a between-subjects effect at Time 2, with a within-subjects effect.

The effect over time
Besides the effects on teamwork KSAs as described above, there was a significant negative effect of time on the development of team orientation, backup behavior, adaptability, and mutual trust. So, over time, these teamwork KSAs deteriorate (see Table 17). These findings match the results from the factorial repeated-measures ANOVA (see Table 19).

Regression to the mean
Finally, it can be concluded from the change-scores analysis that for all teamwork KSAs, a regression to the mean effect could be observed. So, the Time 1 score for the dependent teamwork KSA was a negative predictor of the Time 2 score of that teamwork KSA. This implies that teams that scored low on a teamwork KSA at Time 1, tended to score relatively higher on that KSA at Time 2, whereas teams that scored high at Time 1, tended to score relatively lower on that KSA at Time 2. Nevertheless, since the Time 1 scores for the dependent variables were included in the regression analyses, this effect was corrected for, resulting in the effects as described above.

6.3.6 Summary
Table 21 summarizes the results of the multi-level analyses that were used to test the hypotheses. Although not hypothesized in advance, several teamwork KSAs deteriorate over time. This effect over time will be addressed in the next section.

No predictor affects all teamwork KSAs. However, all predictors affect some or most teamwork KSAs. This implies that no hypothesis is fully supported, but all hypotheses are partially supported. Inter-team cooperation affects the most teamwork KSAs. Except for mutually performance monitoring, all other teamwork KSAs are affected by inter-team cooperation. Feedback affects the least teamwork KSAs. Only team leadership, team briefing, and shared mental models are affected by feedback. Noteworthy are the negative effects of challenging work on team leadership and team briefing whereas challenging work has a positive effect on adaptability.

Table 21
Results for testing the hypotheses concerning the effect on teamwork as analyzed with multi-level regression analyses

		Dependent variable									
Hypothesis	Predictor/control variable	Team leadership	Team briefing	Team orientation	Mutual performance monitoring	Backup behavior	Adaptability	Mutual trust	Shared mental models	Closed-loop communication	Support for hypothesis
	Time →			−		−	−	−			No hypothesis was formulated
25	Potency →			+	+	+	+	+	+		Partially supported
26a	Vertical cohesion with team leader →	+	+	+		+	+	+	+		Partially supported
26b	Vertical cohesion with platoon leader →		+		+				+	+	Partially supported
27	Inter-team cooperation →	+	+	+		+	+	+	+	+	Partially supported
28a	Challenging work →	−	−	+			+				Partially supported
28b	Feedback →	+	+						+		Partially supported
29	High risk circumstances →	+	+		+				+		Partially supported

Note. *A "+" indicates a significant (i.e., $p < .05$) positive effect from the predictor variable on the dependent variable. A "-" indicates a significant negative effect from the predictor on the dependent variable.*

6.4 Discussion
This chapter sought an answer to the question: *'How does teamwork develop over time and what factors are of influence on that development?'* Based on the findings of the survey study that were presented in this chapter, several conclusions can be highlighted.

6.4.1 The effect over time
The military teams that participated in this study, generally, score relatively high on all teamwork KSAs, shortly before deployment. Actually, this might be expected since these teams participated in an extensive training program prior to deployment. In fact, team members, on average, were part of the team for twelve months. Moreover, before entering their team, military personnel participated in individual training programs to enhance their individual taskwork skills and drills, or were part of other teams. So, as a rule, team members are well prepared for their tasks, they are used to work in a military or team environment, and they are familiar with their team mates before being deployed.

Nevertheless, teamwork deteriorates over time. Within teams, team orientation, backup behavior, adaptability, and mutual trust deteriorated in the time span from pre-deployment to mid-deployment.

These changes could not be fully accounted for by the other constructs in this study. So, other factors, not included in this study, must account for teamwork to change over time. Three possible explanations will be outlined below. These are the loss of support for team goals over time, the increase of involvement with home front matters over time at the cost of involvement with team goals and team members, and role differentiation combined with decreased intra-team communication over time.

Loss of support for team goals

Van Dam (2009) offered several observations in his study into soldier's ability to swiftly alter between combat actions and helping activities that might account for an overall deterioration of teamwork over time. Van Dam (2009) noticed that, over time, soldiers in Afghanistan may alienate from mission objectives due to a lack of progress in accomplishing mission objectives, frustration about the sometimes hostile attitude towards the military of (parts of) the population that the soldiers ought to help, and doubts about the meaningfulness of the mission (see also Van den Berg, Dechesne, Soeters, & Duel, 2009). Alienation appears to be one of the primary stressors for military personnel in modern military operations (Bartone, 2006). Aubé and Rousseau (2005) found evidence for the effect of team goal commitment on supportive behaviors within teams, and the latter on team output and the quality of group experience. Whereas support for team goals leads to team members supporting each other both instrumentally and emotionally in attaining these goals, lack of support may give rise to team members to refrain from helping each other, giving each other positive feedback or supporting each other mentally when others need encouragement (Aubé & Rousseau, 2005). So, alienation from team goals over time may (partly) explain teamwork deteriorating in this study.

The increase of involvement with home front matters

Another possible explanation can be based on the results of the study conducted by Wong and Gerras (2006). They studied the effect of the Forward Operating Base on the life of combat soldiers while being deployed. Soldiers are separated for months from their families and friends while being deployed. Communication facilities at the Forward Operating Base (e.g., email, telephone), however, enable soldiers to stay in close contact with their families and friends at home which may lead to increased interaction with the home front. Although the possibility to communicate with relatives as such is good for soldier's morale (Wong & Gerras, 2006), frequent and qualitative communication (i.e., reflecting a depth and level of interaction beyond the superficial) enables soldiers to stay extremely well-connected, making it possible to handle problems at home, deal with issues, and get involved emotionally in home front matters (almost) real time (Wong & Gerras, 2006). As a consequence, both the family and the military as "greedy institutions" (Wong & Gerras, 2006, p. 20; see also Segal, 1986) demand considerable amounts of soldier's loyalty, time, and energy (Wong & Gerras, 2006). Wong and Gerras (2006), therefore, pose the question whether the family competes for deployed soldiers' loyalties at the cost of loyalty to one's comrades. In fact, it appeared that due to intense communication with the home front, the salience of the family's welfare in the minds of soldiers increased over time and so did soldier's concerns for their own safety since they considered the impact of getting killed or wounded on their family's welfare. As a consequence, personal survival became more important than loyalty to team members and mission accomplishment (Wong & Gerras, 2006). In Chapter 5, it appeared that team orientation is an important attitude subsuming teamwork and an antecedent of several other teamwork KSAs. A characteristic of team orientation is that the team member places team goals over individual goals. The effect of intense communication with the home front may account for the emergence of 'family orientation' and self-preservation over time at the cost of team orientation and as a consequence a deterioration of teamwork. Although the emergence of 'family orientation' and self-preservation is understandable from the soldier's perspective, the possible shift in orientation from the team to the family does not benefit the team's performance.

Role differentiation combined with decreased intra-team communication

A third possible explanation for the overall deterioration of teamwork over time is provided by Katz (1982). He argued that as group longevity increases over time, role differentiation within the group increases also, whereas intra-team communication diminishes.

> As [team] members work and gain experience with one another over a longer period … they come to know each other well, know what to expect from each other, and consequently, there is simply less need for talk and interaction among all [team] members. Their perceptions of each other's capabilities, interests, and contributions become clearer and more well defined, with members functioning in ways that gradually regularize and stabilize these role differences. As a result, overall levels of intragroup interaction will be less with high group longevity, causing [teams] to lose access to much of their internal talent and reducing their total capacity for learning new ideas from one another (Katz, 1982, p. 85).

One might argue that role differentiation with decreasing levels of intra-team communication may lead to overall deterioration of teamwork. There is less need for team leaders to act and brief the team since team members more or less act routinely. Team orientation, mutual trust and helping behaviors diminish since team members are less open to each other's opinions, feedback, experiences, and needs. Moreover, since exchanging information and ideas diminish, the team's ability to adapt will be impaired.

It is imaginable that the effect of diminishing intra-team communication due to an increase in the team's longevity may be amplified by the effect of the emergence of 'family orientation' at the cost of team orientation which also may lead to diminished communication within the team.

Likewise, minor irritation among team members, together with increased involvement with homefront matters may also account for diminishing intra-team communication. Op den Buijs (2004) studied the effect of work characteristics on the health and well-being of soldiers that were deployed. She found that with increasing deployment length, the amount of irritations among team members rise. These irritations, when unresolved, may impair the team's functioning (De Dreu & Weingart, 2003; Jex & Thomas, 2003). If soldiers are busy being connected and concerned with their home front, this may imply that less time and/or willingness is available to resolve irritations and to invest in good relations between team members which may lead to a deterioration of team orientation, mutual trust, and the willingness to backup each other when needed.

So, together, the loss of support for team goals over time, the increase of involvement with home front matters at the cost of involvement with team goals and team members, and role differentiation combined with decreased intra-team communication over time may provide for some understanding why time may affect teamwork to deteriorate over time.

6.4.2 The effect of potency

It was hypothesized that the collective belief of team members that their team can be effective would positively affect teamwork. Indeed, potency affects team member's orientations towards their team. The more team members think their fellow team members are capable in performing their tasks successfully, the more team members are considerate towards each other, value each other's contributions, and prefer team goals over individual goals. Moreover, they are more inclined to trust each other, and to monitor each other's performances, and provide for emotional and practical support when needed. They are also more aware about each other's contributions in task performance. That is, they more share mental models. Finally, the more team members think their team is potent, the more they think that the team adequately adjusts to changing circumstances, internal and external to the team.

The team's potency does not affect the team leaders' activities within the team. A possible explanation may be that the effect between potency and team leader's activities is the other way around. That is, the team leader affects potency beliefs within teams. In fact, De Jong, De Ruyter, and Wetzels (2005) found that supportive behaviors by management, such as being accessible, giving information, and giving respect and recognition, positively affect the team's potency beliefs. The relation between potency and team leader behaviors does not concern the task-related behaviors of the leader, but the social support-related behaviors. Since these latter behaviors are labeled vertical cohesion in this study, it may be expected that vertical cohesion affects potency. An indication that this relation may exist, can be drawn from Table 18 (correlations). In that table it can be seen that vertical cohesion and potency are moderately to strongly correlated. However, interestingly, at Time 1, this correlation concerns the relation between vertical cohesion with the *team* leader and potency, whereas at Time 2, this correlation concerns the relation between vertical cohesion with the *platoon* leader and potency. So, assuming an effect of vertical cohesion on potency, there appears to be a shift over time when being deployed, between the source of support that may affect the shared confidence that the team will be competent within military teams.

6.4.3 The effect of vertical cohesion

Vertical cohesion was expected to affect teamwork since it provides for a supportive, constructive, and positive climate within the team. This effect was indeed found for the team leader, and to a lesser extent for the platoon leader. Team leaders that are considered considerate and competent are more communicative towards their team. These team leaders are more inclined to provide for direction and information. Moreover, they contribute more to a pleasant atmosphere in the team, and they motivate their team members more. Further, vertical cohesion indeed affected team members attending towards each other, being supportive and trusting towards each other, and being aware of each other's roles and contributions when performing tasks. Finally, vertical cohesion with the team leaders affects the team's ability to reflect on how tasks are completed so team performance can be improved when necessary.

Vertical cohesion with the platoon leader has less distinct impact on teamwork than the bonding with the team leader. Its impact is on the implicit and explicit coordinating mechanisms within the team. A possible explanation is that a tight bonding with the platoon leader may provide the team with more information which is consequently briefed to the team (see e.g., Oh, Labianca, & Chung, 2006). Based on this information, team members within teams are more able to explicitly, and implicitly coordinate their actions.

Interestingly, contrary to the modest effect of team leadership on the team's function that was found in Chapter 5, vertical cohesion with the team leader affects most teamwork KSAs. An explanation for this is that team leadership more reflects the team leader's task related activities, whereas vertical cohesion with the team leader more reflects the social aspects of the leader's job. In the previous chapter, it was concluded that the task related aspects of team functioning can be shared among team members. Several teamwork KSAs, when performed well, reflect this distributed team leadership. Monitoring each other, and giving guidance, and assistance to each other, are examples of task related leadership activities that can be executed by all team members. So, the need for task related leadership activities by the team leader is less necessary when teams are high on teamwork. However, supportive and considerate activities by the team leader are important in establishing a positive interpersonal team climate in which team members are more inclined to attend to each other, and to help each other (Chen, Chang, et al., 2007; Walumbwa, et al., 2009). By being considerate and supportive, a team leader reinforces such a positive interpersonal team climate and, as a consequence the task related leadership activities become more shared among team members, making task-related activities by the team leader redundant.

6.4.4 The effect of inter-team cooperation

Inter-team cooperation affects all but one (i.e., mutual performance monitoring) teamwork KSAs. Teams that are highly integrated with other teams by working together intensely, in exchanging experiences with other teams, and in trying to learn as much as possible from other teams, perform better on teamwork. So, the more closely teams work with other teams, the more closely the team members work with each other.

As was mentioned in section 2.2, a characteristic of the military team is its embeddedness in an organizational context which heavily affects the team's performance (see also Figure 1). Military teams are tasked by the organization, receive information (e.g., intelligence concerning the whereabouts and ways of conduct of Opposing Militant Forces) that is needed to estimate the situation, and receive support when performing their tasks. This support may be logistical support, such as the provision of ammunition, fuel, food, and other essential supplies. Support may also be provided by giving fire support or medical aid to the team. Further, military teams normally perform their tasks together with other teams.

A team can be regarded a node in a web, or network, of ties that relates the team to other organizational parts (see Katz, Lazer, Arrow, & Contractor, 2004). Moreover, team members themselves can be regarded as nodes that are related to other persons, both inside and outside the team (see Katz et al., 2004). Teams, and team members with abundant ties with other persons and organizational parts outside the team, may have fuzzy, rather than firm team boundaries (Katz et al., 2004). That is, the distinction between the team and its embedding context gets blurred. Nevertheless, these ties make it possible for teams to draw on various resources outside the team (Oh, et al., 2006). Besides the resources mentioned above, such as supplies, and information, resources may also entail emotional or social support, trust, and lessons learned.

Thus, teams that are tightly connected to other teams and the organizational context, have more sources to draw support from that may enhance teamwork. Moreover, in teams with fuzzy team boundaries, the activities of other organizational parts outside the team may have more impact on team processes, such as teamwork, than in teams with more firm boundaries.

For teams to be effective, boundary spanning, that is drawing on external ties to access resources for the team (Katz et al., 2004) is important (Ancona & Caldwell, 1992; Choi, 2002; Oh et al., 2006). However, according to Choi (2002), internal and external activities of teams compete with each other since both draw on limited team resources, such as time, effort, and personnel. For example, a military team that is ambushed may be busy in defending itself, fighting the Opposing Militant Forces, and getting a clear picture of an often hectic and confusing situation. The team is busy with adapting to the new situation, monitoring each other's status (are team members wounded or not?) and whereabouts, helping each other, providing each other with information and guidance. In such situations, commanders and team members 'on scene' may be too absorbed in the situation and their own internal activities, and may have no time for external activities that may be necessary also, such as informing higher echelons (see Vogelaar, 2009), synchronizing their activities with teams nearby, or arranging support activities (see Van Bezooijen & Kamphuis, 2009). Therefore, one could argue that external circumstances, especially stressful circumstances, may drive the team towards high quality teamwork resulting in limited team resources being available for external activities.

6.4.5 The effect of challenging work

In general, over time, team members experienced their work as being less challenging and stimulating. Moreover, these team members encountered less circumstances in which they could show their worth, and in which they could take initiative. Change in challenging work was hypothesized to positively affect a change in teamwork. This hypothesis was not fully supported. In fact, positive change in challenging work negatively affected change in team leadership and team briefing behaviors. The following explanation may account for that. Teams that increase in challenging work have team members who over time experience more responsibilities in their job, who are more able to show their worth in their job, who experience their job as being more challenging and stimulating, and who are able to take more initiative. Within these teams, there is less need for team leaders to stimulate team members, to establish norms of conduct, to correct or direct team members or to brief team members and as a consequence team leadership and team briefing behaviors diminish over time.

Like it was hypothesized, teams with team members high on challenging work are more adaptive and team oriented. After all, team members in these teams express what in military jargon is called a "can-do" mentality. This mentality refers to a kind of pro-active, positive attitude aimed at tackling problems together and completing team tasks with vigor. This mentality facilitates flexibility among team members, addresses their problem solving capabilities and awareness for possibilities within the environment, which are needed ingredients for team adaptability.

6.4.6 The effect of feedback

Teams with a growing climate of providing feedback towards each other, are more experiencing the team leader being more communicative by giving information, directions, and briefings. Moreover, more feedback leads to a higher extent of shared mental models among team members. The question is why feedback did not affect other teamwork KSAs. A possible explanation is that in this study, feedback was measured using one item only. This item may not have been a robust indicator of feedback, and as a consequence, the relation between feedback and other constructs may not be measured adequately, accounting for the lack of effect. Moreover, the item was concerned with the sufficiency of feedback on the team member's performance (i.e., *my* job performance, emphasis added). It is more likely that this item taps feedback on *individual taskwork* instead of feedback on *collective teamwork*. If so, it is not likely that such feedback leads to improved team performance since feedback on individual performance leads to team members focusing their attention and effort on improving individual task performance instead of improving collective team performance (DeShon et al., 2004). So, for teamwork to be enhanced, teams should be given feedback on team level performance (DeShon et al., 2004).

6.4.7 The effect of high risk circumstances

It was hypothesized that high risk circumstances would induce teams to be more constricted in control and would lead to attentional narrowing. Because of the first tendency, it was hypothesized that high risk circumstances would positively affect team leadership. On the other hand, attentional narrowing with team members becoming more self-focused at the cost of being inclined to attend to other team members, was expected to negatively affect teamwork.

The first part of the hypothesis is fully supported. Indeed, teams in high risk circumstances report more team leadership and team briefing activities. So, in teams that are confronted with demanding and threatening circumstances on a regular basis, team leaders play a more prominent role as compared to their colleagues who lead teams that do not work in high risk circumstances. This dominant role is expressed by team leaders, among other things, providing more guidance on what goals to achieve, how tasks should be executed, what roles team members have to perform and how, and what norms to adhere to.

The second part of the hypothesis is not supported. Team members in teams in high risk circumstances do not deteriorate in mutual performance monitoring. Instead, it appears that within teams that operate in high risk circumstances, mutual performance monitoring is performed more intensely than in teams that do not operate in high risk circumstances. Moreover, team members that operate under risky circumstances report being more aware of their mutual taskwork and teamwork contributions when performing team tasks. That is, mental models are more shared within teams that operate in risky circumstances, as compared to teams that do not. So, when the going gets tough, and the team's safety is at stake, team members, based on a solid shared understanding about what must be done, by who, and when, are more inclined to check whether task performance progresses as planned. Further, team members are more inclined to check whether their team mates have difficulties in performing their tasks, or to provide each other with directions so task performance can be improved or adjusted.

A possible explanation for this is that these military teams are well trained and prepared for working in high risk situations. So, the patterns of behaviors for working in those circumstances have become, what Gersick and Hackman (1990) refer to, as habitual routines. The military training prior to deployment, and possibly when being deployed, instilled the individual and team skills and drills that are necessary to perform well in these high risk situations as habitual routines. Chapter 1 started out with an exemplary description of a team that relied heavily on its skills and drills, among them monitoring each other, and helping each other, when confronted with an ambush, a high risk situation indeed. In such situations, teams more or less automatically switch into, what they sometimes refer to as a "drill mode". Team members know exactly what to do and what to expect from other team members. The example with which Chapter 1 started, also provided a nice example of the team leader's role in such high risk circumstances. The team leader guides and directs the team, given the situation at hand, and team members, based on their trust in the team leader, follow the team leader's orders.

6.5 Conclusion

In conclusion, teamwork changes over time and in general teamwork deteriorates slightly. This deterioration of team orientation, backup behavior, adaptability, and mutual trust cannot only be accounted for by the influence of the antecedents of change that were included in this study. So, other factors also affect the development of these teamwork KSAs in the time span between pre-deployment and mid-deployment. It was suggested that loss of support for team goals over time, the increase of involvement with home front matters over time at the cost of involvement with team goals and team members, and role differentiation combined with decreased intra-team communication over time may also account for teamwork to deteriorate.

Several factors have an effect on the development of teamwork within teams. Potency, as well as vertical cohesion with the team leader, vertical cohesion with the platoon leader, inter-team cooperation, challenging work, feedback, and high risk circumstances each affect several teamwork KSAs. However, no factor affects all teamwork KSAs. As was mentioned in section 3.5, this chapter would be more explorative in nature in trying to find empirical evidence for factors affecting teamwork development over time. Based on the literature, several potential relevant factors were selected. With the advise of Argote and McGrath (1993) in mind (see section 2.5.2), that field studies should include as many relevant factors as possible, general hypotheses about the effects of these factors on teamwork in general were formulated. And, as a result of that, no fine-grained hypotheses were formulated to test for effects of each variable on each specific teamwork KSA. Nevertheless, this chapter provided for fine-grained support for the effect of each specific factor just mentioned on specific teamwork KSAs. From these factors, inter-team cooperation, vertical cohesion with the team leader, and potency, seem to be of most importance for sustaining or leveraging teamwork over time, based on the amount of teamwork KSAs they affect. So, teams that over time act more integrated with other teams, also act more integrated themselves over time. Further, improvement in considerate and competent behavior by the team leader leads to subsequent behaviors by team members. As a consequence they are more attending to each other and are more supportive. These effects also occur when teams increase in their awareness of being potent as a team.

Although the study in this chapter has several limitations, which will be elaborated in the next chapter together with some directions for future research, this study provided for the highly needed empirical insights on the development of teamwork within real teams that perform real tasks under real circumstances. The body of knowledge on teamwork and its development is predominantly based on studies using ad hoc teams with assigned tasks in laboratory settings. Therefore, the results of this longitudinal field study in which military teams perform combat actions, reconstruction activities, and all kinds of other military tasks for months under challenging, and sometimes life-threatening circumstances in Afghanistan and Bosnia-Herzegovina, make an important contribution to that body of knowledge. The practical implications of this study will be outlined in the next chapter.

7.

General discussion and conclusion

7. General discussion and conclusion

7.1 Summary

Teamwork is highly valued in the military. Teams are the cornerstones of military units that are deployed to areas all over the world to perform in demanding and challenging, sometimes overtly hostile and mortally dangerous circumstances, and for most teams in this study these deployments last for up to four months. The circumstances under which these teams perform, no matter how difficult they may be, require of military personnel to remain committed to the team and its tasks so the military may ultimately reach its objectives. The Code of Conduct for Netherlands Armed Forces' military personnel explicitly mentions the importance of teamwork and 'being a team member' is one of the three overarching attitudinal training objectives within the Royal Netherlands Army.[33] This implies, among other things, that soldiers are trained to trust and respect each other, to help each other both physically and mentally, and to be open, constructive, and positive to other team members.

Teamwork, however, can never be taken for granted in military teams, even when these teams are trained extensively (see Chapter 1). Over time, among other things, frictions, irritations, conflicts, and misunderstandings within teams may emerge that may impair teamwork and as a consequence, the team's effectiveness. So, how can those who train and lead teams, instill and leverage effective teamwork within military teams, and, what should be done to sustain teamwork over time, especially when performing conditions for military teams are adverse and challenging?

Although both military and scientific scholars agree that it is teamwork that ensures the success of military teams, teamwork itself receives modest research attention within the military. Outside the military, however, teamwork has been studied more extensively. The results of the studies do not provide clear-cut answers to what teamwork is about and how it affects team effectiveness. Nor is it clear how teams sustain teamwork over time. This is problematic, since no clear guidelines are available for practitioners, such as team members, and those who lead and/or train teams what KSAs are critical for effective teamwork, and what factors affect these KSAs while military teams are deployed on missions. Therefore, the following central research question was formulated.

What effect does teamwork in military teams have on team effectiveness and how do military teams sustain their teamwork over time?

In answering this question, this study focused on military teams, preparing for, or conducting Peace Support Operations. The military teams that were the object of this study could be characterized as action teams (e.g., Sundstrum et al., 1990). A key characteristic of action teams is that their team members are highly interdependent when performing their tasks.

Chapter 2 reviewed the team literature to delineate what is known on teamwork and how it affects team effectiveness. First, a general framework of team performance was introduced (see Mathieu et al., 2008). In this framework, input factors at the individual team member level, the team level, and from outside the team may affect team processes and emergent states. These in turn affect team effectiveness. Three outcomes may provide an indication about the team's effectiveness (Hackman, 1985, 1987).

[33] The other two overarching training objectives within the Royal Netherlands Army are: being prepared to fight, and being mentally tough. See Koninklijke Landmacht (2009).

First, the team output should meet the demands of those who receive or review. Second, the team members should be able and willing to contribute to the team's endeavors in the future, and, third, the team member's needs should be more satisfied than frustrated by the team's performance.

For insights in teamwork, a recent contribution to the teamwork literature was reviewed. In that contribution, Salas et al. (2005) organized the abundant research findings on teamwork into a theoretical model that contains the knowledge, skills, and attitudes (KSAs) that were claimed to have the highest impact on team effectiveness. Besides identifying the KSAs, a model was presented that clarifies the interrelatedness of the KSAs and their relations with team effectiveness. What is more, the KSAs can be improved by interventions. So, the model appears to be an interesting, practical guide for those who train or lead teams, who review teamwork, or are team members themselves, and those who are interested in leveraging team performance.

According to the model, teamwork requires team leadership, team members being oriented toward their team, the monitoring of each other's performances, and providing for practical and emotional support. Also scanning for, and being responsive to changes internal and external to the team, in short being adaptive, contributes to teamwork. In addition to these five core KSAs, team members have to trust each other, share mental models on team and taskwork, and should engage in closed-loop communication.

Besides the relations between teamwork KSAs, and between teamwork and team effectiveness, as outlined in the model, an additional review of the literature provided support for several alternative relations between the teamwork KSAs in the model. Some of these relations were already suggested by the authors, however they were not incorporated in the model.

Furthermore, the literature was reviewed to find insights on how teamwork develops over time, and what factors may be of influence on that development. According to 'path dependent models', team development can be described as a linear process in which teams go through distinct stages of maturation, resulting in an optimal end state (e.g., Tuckman, 1965; Chang et al., 2006). Team development may be an informal process, but formal activities such as training and team building may also affect team development. The end state is sometimes described as a robust equilibrium in which teams use habitual routines when performing (e.g., Arrow et al., 2000). Several authors suggested, however, that contextual factors may affect teams to change default patterns, or habitual routines (e.g., Gersick & Hackman, 1990; McGrath, 1991). Besides some indications that team performance might deteriorate over time (Kozlowski & Bell, 2003), few additional insights were available about factors that may affect teams to change default patterns, or habitual routines. Based on the literature review, it was expected that potency, vertical cohesion, inter-team cooperation, satisfaction with job characteristics, and high risk circumstances might be factors that can explain teamwork to change within teams while being deployed, which is a major change in context, as compared to the initial, safe training situation prior to deployment.

In Chapter 3, hypotheses were formulated that would be tested in this study. Twenty-four hypotheses were formulated to test the relations between teamwork KSAs and between teamwork and team effectiveness. Five additional hypotheses were formulated to test the effect of the antecedents of change in teamwork on teamwork KSAs. Consequently, Chapter 4 outlined how the study was conducted. The population consisted of military personnel that participated in a survey study at the end of an extensive training period, shortly prior to deployment to a Peace Support Operation, and at mid-deployment. The time span between both measurement moments varied but was approximately five to six months. Most of the participants were deployed to the International Security Assistance Force mission in the southern province of Uruzgan, in Afghanistan. The remaining participants were deployed to the European Union Forces mission in Bosnia Herzegovina. Chapter 4 introduced the instruments that were used to collect the data on the constructs of interest. The reliabilities and discriminant validities of the constructs were analyzed and appeared to be satisfactory, albeit that the initial team leadership construct appeared to be composed of two constructs (consequently labeled team leadership and team briefing), and satisfaction with job characteristics also subsumed two constructs (which were consequently labeled challenging work and feedback). Finally, in Chapter 4, it was analyzed whether the individual level data could be aggregated to the team level. The analyses provided support for this aggregation. Consequently, for each construct, the data for the individuals within each team were averaged. These averaged scores represented the team score on that construct.

The purpose of Chapter 5 was to determine how the teamwork KSAs were related to each other and to team effectiveness. In this chapter, teamwork within 236 military teams prior to deployment, and 208 military teams that were deployed to a Peace Support Operation abroad, was studied. Based on this field study, it appeared that the core of teamwork consists of team orientation affecting backup behavior. This in turn affects team adaptability, and together backup behavior and adaptability affect team effectiveness. So, the more team members are convinced they should work together, and are considerate towards their team mates, the more they are inclined to help each other, whether that may be by practical or emotional support, and the more inclined they are to shift workload among themselves. This affects the team's ability to adjust to internal, and external changing conditions, and this in turn affects the team's effectiveness. Mutually performance monitoring plays a modest role in teamwork within military teams. So do shared mental models, and closed loop communication. These latter two mechanisms facilitate the coordination among team members when they monitor each other, support each other, or when they adjust to changing circumstances.

Interestingly, mutual trust's effect on teamwork appeared to be different from the effect that was postulated in Salas et al.'s (2005) model. Instead of providing for a positive atmosphere that facilitates mutual performance monitoring to take place, it facilitated backup behavior in that trust provides for the legitimacy of need for help. Moreover, it positively affected the team leader's actions, guidelines, and directions.

Also interesting is the effect of team leadership. Instead of the team leader facilitating monitoring behaviors among team members, and enhancing supportive behaviors among team members, as proposed by Salas et al. (2005), team leadership affects shared mental models, and the team's ability to adapt. So, team leaders contribute to concerted team action in providing and updating the team with information on the task, and how team members should perform their roles and tasks. Likewise, team leaders play an important role in determining when teams should adjust when the situation, both internal and external to the team, requires the teams to do so. It was suggested that substitutes for leadership, or distributed leadership may account for the non-existence of the leader's effect on the initially hypothesized relations between team leadership and teamwork KSAs. This implies that team members may collectively perform team leadership functions, such as monitoring each other,

checking for task progress, providing each other with directions, and in deciding to shift workload among each other. In doing that, the team members make actions by the team leader redundant.

Finally, this study on teamwork in military teams revealed that two effects may be missing in the model. Both effects are needed to adequately explain teamwork within military teams and its effect on team effectiveness. First, it is suggested that the amount of specialized skill within teams may, on the one hand, enhance the team's variety of skills, and in that the team's ability to adapt to various circumstances. On the other hand, however, specialized skill restricts the ability for team members to be able to fully backup each other and as a consequence impairs the ability to adapt, for example, to changing internal conditions within the team. Second, better teamwork leads to increased team member's feelings of being bonded with their team mates, and being respected, for example, for their contribution to the team effort. These feelings of cohesiveness and being respected may also be affected by consideration or social support among team members (Griffith, 2002).

The purpose of Chapter 6 was to determine how teamwork develops over time, and what factors are of influence on that development. Therefore, 144 teams were studied. The teams were represented by at least two team members, and all team members participated in a survey study at both measurement moments. It was found that several teamwork KSAs deteriorated over time. First, team member's orientation towards their team diminished. Likewise, team member's helping behaviors towards each other, and their trust in team mates diminished. Finally, team members were less inclined to adapt to changing circumstances over time. These deteriorations could not be fully accounted for by the other factors that were included in the study. Therefore, several suggestions were offered that may account for teamwork to deteriorate over time. These suggestions are the loss of support for team goals over time, the increase of involvement in home front matters over time, at the cost of being involved in team matters, and role differentiation, combined with decreased communication within the team over time.

The study provided support for the positive effect of several factors on teamwork development. These factors are potency, vertical cohesion, inter-team cooperation, feedback, and working in high risk circumstances. It should be noted, however, that these factors did not affect all teamwork KSAs. The pattern of influence appeared to be complex, with all factors affecting some, and sometimes most, teamwork KSAs, but no factor appeared to be affecting all teamwork KSAs. Finally, challenging work appeared to have a negative effect on team leadership and team briefing, whereas it positively affected several other teamwork KSAs. The negative effect could be explained since team members high on challenging work indicated that they were able to show their worth in challenging and stimulating tasks. Moreover, these members were able to take more initiative and experienced more responsibilities. In these circumstances, there is less need for team leaders to provide for direction to these team members, or to motivate them, to keep the team going.

7.2 Strengths and limitations of this study, and avenues for future research

7.2.1 Strengths of the study

This study offered several strengths. First, the study was built on existing knowledge. Although this may seem obvious at first hand, it appears that in the team research domain this is not always the case. As Rousseau et al. (2006) noticed, and as it was mentioned in the first chapter, few researchers try to integrate and build on various research findings that were found outside the line of research they pursue themselves. Instead, this study was firmly embedded in existing knowledge. First, teamwork was framed within a well known model of general team performance. That is, the extension of the Input-Process-Output framework (see e.g., McGrath, 1964) into the Input-Mediator-Output framework (see e.g., Ilgen et al., 2005, Mathieu et al., 2008). This framework makes clear how teamwork is related to other factors that may affect team performance, and how teamwork relates to team effectiveness. Second, teamwork, as it was studied in this thesis, was built on the work of several researchers who are well known for their contributions to the team literature. Moreover, the model of teamwork that was used in this study was built on the integration of numerous empirical and theoretical findings in the literature. So, this study was built on a solid theoretical foundation.

Second, this study responded to the frequently mentioned suggestion that teamwork research should be taken out of the laboratory into the field (see e.g., McGrath et al., 2000; Salas et al., 2006, 2008). Although there is nothing wrong with doing research in the laboratory, it is generally acknowledged that findings from laboratory studies do not always hold when studied in the field. This is because in the "real world" a myriad of other factors than studied in the laboratory, may also affect the variables of interest or their interrelatedness. For example, several studies that were cited in this book used university students as participants. These students were grouped, and consequently were asked to perform tasks such as 'flying' a fighter aircraft or helicopter on a computer. These studies usually can not account for the effect of team members knowing each other for longer periods of time, for being trained extensively (together) on the task at hand, and for the fact that in real life, flying an aircraft or helicopter is so complex, dynamic, and difficult that few persons ever pass the selection process and training before even becoming a pilot. So, it is necessary to test findings from laboratory studies in 'the wild' to find out whether these findings also apply in realistic settings.

However, conducting research in the field is often difficult and may have several limitations. Concerning this study, it was difficult to get access to the participants, especially to the troops that were deployed to Afghanistan. At the time of the study, it was unclear what effect the hostilities of opposing militant forces might have on the troops. It was feared that the troops might take numerous casualties. So, the army was reluctant in providing access to the troops. In that way, the army tried to avoid taking unnecessary risks by deploying personnel into the area of operations temporarily, that were not vital for the operations, such as researchers. Nevertheless, by incorporating this research into morale research, which is normally conducted for troops that are (to be) deployed (see Chapter 1), this study could be conducted. And in doing so, data from real teams in real settings, doing real work could be obtained.

A third strength of this study is that large numbers of respondents participated in it. Moreover, these respondents could be grouped into numerous teams. Since the results of this study are based on these numbers of respondents and teams, the findings may be regarded robust.

7.2.2 Limitations of the study

Besides this study offering several strengths, several limitations of this study must be mentioned also. The first is concerned with the generalizability of the results. The teams that were the object in this study were military teams preparing for, and conducting Peace Support Operations. Although the teams differed in size, tasks, and contexts in which they operated (see section 4.2), overall the teams

could be characterized as action teams (see section 2.2) and most of them operated in, what Kolditz (2006, 2007) refers to as in extremis settings (see section 2.5.2). According to Kolditz (2007), this kind of setting is also typical for teams that comprise of law-enforcement officers, fire fighters, adventurous sports teams, and the like. These teams may all be regarded as action teams. So, one could therefore argue that the research findings of this study will also apply for action teams that more or less share the same in extremis or naturalistic (Orasanu & Connoly, 1995) context when performing its tasks. One should be cautious, however, in generalizing this study's results to other samples of respondents or contexts. Further, what the results regarding the relations among teamwork KSAs are concerned (see Chapter 5), one should be careful in applying these results to teams that do not share more or less the same cultural background as the military teams in the Royal Netherlands Army.

Second, mono-method bias should be addressed. In this study, the team members were asked to provide information on teamwork, team effectiveness, and other team processes and emergent states. For that, a questionnaire was used that assessed the variables of interest simultaneously. This research strategy may lead to mono-method or common-method bias (see e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Among the many sources of mono-method bias are the respondent's tendencies to answer consistently and in a socially desirable way, the respondent's mood state, item characteristics, and measurement context effects (Podsakoff et al., 2003). These sources may affect how respondents comprehend the questions and instructions, how they retrieve information from their memory, how this information is judged upon, what response options are selected and how they are reported (Podsakoff et al., 2003). As a consequence, mono-method bias may lead to systematic measurement error that may confound empirical results (Podsakoff et al., 2003).

Several measures were taken to minimize the effects of eventual mono-method bias. First, great care was taken in constructing the questionnaire. The questionnaire used phrases and wordings that the respondents were familiar with to prevent problems in interpreting the meaning of the questions posed. Moreover, each topic of interest was separated from the other and introduced so respondents were framed in the right mind-set for each construct. Consequently, the items measuring the constructs were clustered beneath that introduction which facilitated retrieval of information on the subject at hand. In addition, response options were kept the same as much as possible to facilitate cognitive processing of the possibilities. Next, the length of the questionnaire was kept to a minimum to prevent the questionnaire becoming cognitively demanding or personnel losing motivation to give their full attention in filling out the survey. Next, military personnel that were tasked with conducting the survey were given an instruction how to conduct the survey. Among the issues they mentioned when informing the respondents, were the goal and importance of the research, that commanders endorsed the research, and that respondent's confidentiality would be guaranteed. Finally, before analyzing the data, the discriminant validity of the constructs was tested. So, although there is no guarantee that mono-method bias is nonexistent in this study, it is tried to limit its effect as much as possible, given the possibilities and constraints regarding this study.

The third limitation is concerned with the study's design. Although teamwork, team effectiveness, and several other variables were measured twice (i.e., before deployment and at mid-deployment), in essence this study used a cross-sectional design to answer the question how teamwork KSAs affect each other and team effectiveness. When using a cross-sectional design, no inferences can be made on cause and effect relations. Still, the model that was analyzed in this study was based on empirical findings, most of them gained in a laboratory setting in which it is more easy to discern cause and effect relations. Therefore, it is argued that conclusions about the cause and effect relations among teamwork KSAs and between teamwork and team effectiveness, based on this study's results, are warranted. For the cause and effect relations as studied in Chapter 6, the argument of the cross-sectional design also applies. Since the theoretical underpinnings of the hypothesized effects in this chapter were less extensive, the results may indicate that these cause and effect relations are plausible. It should be noted that this part of the study, as was mentioned in section 3.5, was more explorative in nature.

Further, by using two measurement moments, the development of teamwork and other factors could be analyzed. The question, however, is whether this longitudinal design is appropriate for identifying teamwork development, and the development of other factors. After all, the time span between both measurements was several months. Many things may happen and actually did happen in that period of time. It is imaginable that the development of teamwork and other factors of interest develop following a more complex pattern than can be identified by measuring them at two moments in time with an interval of several months. In fact, Van der Kloet (2005) studying the development of trust among soldiers being deployed on low intensity conflicts, found facets of trust within military units to develop following a U-pattern in some units, or inverted U-pattern in other units, besides the more general linear patterns in most units. So, although measuring teamwork and other factors of interest at two moments in time may provide for the necessary conditions to detect any development at all, more measurement moments may provide for a more fine-grained picture of the development of the variables of interest. Still, it should be reiterated that getting access to the troops once, when they were deployed, was a major challenge in this study, let alone getting access twice or more than that. Therefore, this study was restricted to two measurement moments.

A final aspect regarding the design is concerned with the attrition of respondents. Unfortunately, not all respondents took part in both measurement moments. As was mentioned in section 4.3, several reasons could account for respondents not taking part in the research before deployment or while being deployed. Before deployment, personnel or teams could be missing in this research because of (individual) training programs or leave. While being deployed, personnel could be missing because of being on long-range patrols or being stationed at out-posts for days so they could not participate in the survey study which was conducted at the Forward Operating Base. As a result, the number of teams that participated in the study before deployment and while being deployed was not the same. Moreover, not all teams participated at both measurement moments. This was especially unfavorable for the analyses in Chapter 6, in which only teams were included that were represented by at least two respondents who took part in both measurement moments. Still, attrition of respondents is a drawback not uncommon for longitudinal research, and the remaining number of teams (N = 144) was more than sufficient to answer the research question. Moreover, all kinds of team types were included in the remaining teams, such as combat teams, logistical teams, command teams, engineers, Provincial Reconstruction Teams, and reconnaissance teams. However, the 144 teams scored significantly higher on all teamwork variables at Time 1 (differences ranging from .14 to .18) and most teamwork variables at Time 2 (except for team orientation, mutual trust, and closed-loop communication). These differences ranged from .15 to .25. In addition, at Time 2, the 144 teams scored significantly higher on potency (.13) and challenging work (.13).[34]

[34] A one-way ANOVA was conducted with teams taking part in both measurement moments or not being a factor, and the nine teamwork variables, the three team effectiveness indicators, and the six antecedents of change as independent variables.

So, there may be a bias towards better performing teams that were included in the analyses of Chapter 6. Since several logistical and combat support teams did not participate in the survey at both measurement moments (see Table 8), the sample of 144 teams contained relatively more infantry and engineer teams. Infantry and engineer teams are trained extensively as teams prior to deployment, even more than logistical and combat support teams. This may account for the higher scores in general on teamwork for the 144 teams, as compared to the teams that did not participate at both measurement moments. This may imply that the results of Chapter 6 are more generalizable to teams that are extensively trained for teamwork and that work and live under the most challenging and demanding circumstances, whereas the results should be generalized to other types of teams with caution.

7.2.3 Avenues for future research

The results of this study, and the study's limitations, point at several avenues for future research. First, in Chapter 5 it was concluded that several relations between teamwork KSAs need to be further investigated. More specific, the relations in the model that were not significant and the relations that were added to the model need to be studied in more detail. Moreover, it was suggested, in Chapter 5, to replicate the results of the study. However, with the limitations of the generalizability of the results in mind, the study not only needs replication with similar respondents working in similar contexts. Apart from that, the study should be replicated in different contexts with different samples of respondents, and with a wide variety of teams before definite conclusions can be drawn about the relations among teamwork KSAs and between teamwork KSAs and team effectiveness. For example, studying ad hoc teams, teams with distinct variations in tenure, and teams in which team members differ more among themselves in the taskwork KSAs they possess, will enhance our knowledge about the applicability of the teamwork KSAs in a wide variety of conditions.

A special condition worth mentioning is the cultural background of the team members. One of the findings in Chapter 5 was that leadership appeared to have less effect than expected in advance. It was argued that the distribution of leadership, or sharedness of leadership, among team members may have accounted for that. In the Royal Netherlands Army, military personnel are trained to take initiative, to be proactive, and to take responsibility when the occasion occurs. Moreover, military commanders are trained to delegate and to tell people *what* to do, not *how* to do it, as much as possible. This does not imply that military leaders in the Royal Netherlands Army are laissez-faire leaders. It merely implies that in the Royal Netherlands Army, military leaders are trained to trust their subordinates to do their best given the situation at hand and to put responsibilities as low in the organization as possible. Besides, when situations are critical, as described in the beginning of this book and following the results in Chapter 6, leaders take command and act more directive. Nevertheless, the Royal Netherlands Army fosters a culture that is relatively low in power distance and uncertainty avoidance. Still, military and national cultures may strongly differentiate between values as power distance and uncertainty avoidance (Soeters, 1997). These values may be important for understanding interactions between leaders and the led and differences between teams in aspects as taking initiative (see e.g., Dekker, Rutte, & Van den Berg, 2008; Den Hartog, House, Hanges, Ruiz-Quintanilla, & Dorfman 1999; Dickson, Den Hartog, & Mitchelson, 2003; Wendt, Euwema, & Van Emmerik, 2009). Team members that share a certain culture may differ from team members sharing another culture on attitudes towards desirable styles of supervision (power distance) and the idea that organizational rules may, or may not be broken, even when one thinks it is in the interest of the organization (uncertainty avoidance; Soeters, 1997). So, military or national cultures that differ from the Royal Netherlands Army culture may have a different impact on teamwork behaviors and therefore one should be cautious to generalize this study's results to teams that have a culture which is, for example, high on power distance and uncertainty avoidance.

Future research should try to incorporate external measures of team effectiveness that are provided by – for example – peers, superiors or formal records. Moreover, special attention should be given in searching for external measures that may provide insight in the team's viability and the satisfaction or frustration of team member's needs. Together with the use of a wide array of research methods, these future study's results will enhance our understanding of teamwork in teams.

In addition, another interesting avenue for future research is investigating the mechanisms that may explain why teamwork deteriorates over time for teams that are deployed to Peace Support Operations. Several possible explanations are offered in Chapter 6, that may serve as a starting point for this research. Besides, what has just been mentioned on replicating the results, unequivocally applies for replicating the results regarding the development of teamwork and the factors affecting that development. Moreover, when studying the development of teamwork it is suggested to incorporate more measurement moments when possible, to provide for a more detailed picture on development.

When searching for those mechanisms, special attention should be given to the possible effect of the working and living conditions of the teams. Typical for military teams in this study is that they worked under demanding circumstances. The team members worked and lived together for 24 hours a day, seven days a week, for several months. These working and living conditions, together with the danger of getting wounded or killed, which applied for a large part of the respondents, may have had serious impact on military personnel. An indication of the impact of these difficult circumstances on the health and well-being of military personnel is provided by the results of the post-deployment health assessment which was conducted six months following redeployment. The following results are based on the responses of 648 military personnel that redeployed from the missions to Uruzgan and Bosnia-Herzegovina that were included in this study.[35] From the respondents, 9.7% had experienced difficulties with transitioning home following redeployment. Next, 17.2% of the respondents experienced physical health problems that the respondents thought were (definitely or probably) related to their deployment. A deterioration in mental fitness as compared to one's mental fitness prior to deployment, was reported by 11.3% of the respondents. Depressive feelings were reported by 10.0% of the respondents. High levels of stress were reported by 8.5% of the respondents. In addition to these 8.5%, another 2.9% of the respondents reported such high levels of stress, that they may indicate Post Traumatic Stress Disorder (PTSD). Finally, 9.0% of the respondents reported symptoms of being severely fatigued. In total, 29.9% of the respondents were indicated for referral by a medical doctor.[36] So, the question is what the effects of intense and extraordinary working and living conditions may have on teamwork development.

[35] For more information on the research project from which these results are obtained by secondary analyses, see Duel (2008).

[36] All military personnel who are indicated for referral are contacted by a medical doctor who explores whether help is needed. In general, approximately 26% of those who were indicated for referral, need additional help by a medical doctor, a social worker, a psychologist, or another caregiver (Duel, 2008).

7.3 Theoretical and practical contributions

7.3.1 Theoretical contributions

Despite its limitations, this study offers several theoretical contributions to the teamwork literature. First, it provides empirical support, based on a field study, for most parts of a recent submitted model of teamwork, that integrated numerous theoretical and empirical findings. The latter are predominantly based on findings from laboratory studies. In that, testing the *integral* model, within *real* teams, performing *real* tasks, in *real* settings, extended our knowledge on the effect of several teamwork KSAs on each other, and team effectiveness.

Moreover, the study reveals that team briefing may be a promising addition to the teamwork model. As team leaders communicate information about goals, tasks and the environment towards their team, this enhances the development of shared mental models among team members, which in turn positively affects team communication processes and team performance (Dalenberg, Vogelaar, & Beersma, 2009; Marks et al., 2000). This applies especially for teams that operate in novel environments because team briefing gives the team the ability to adapt to changing situations (Marks et al., 2000). So, team briefing may be a useful addition to the model especially when the model is used to explain team effectiveness for teams that have to perform in dynamic settings.

The study also contributes to the scientific discussion on teamwork, since it provided for several findings (i.e., relations between teamwork KSAs, or missing constructs) that may be interesting starting points for further studies on teamwork and team effectiveness that will enhance our understanding of teamwork, and how it affects team effectiveness, in the future.

Next, the study provides for insight on teamwork development. It showed teamwork to deteriorate over time. Besides the effect of time itself, the study found support for the effects of potency, vertical cohesion, inter-team cooperation, challenging work, feedback, and working in high risk circumstances on teamwork development. Again, the findings add to our knowledge on teamwork, but also provide for interesting starting points for future research.

Finally, the study used a newly developed questionnaire to measure the teamwork constructs of interest. The items were based on Salas et al.'s (2005) definitions of the teamwork KSAs. The questionnaire is a useful tool in assessing teamwork in a field setting, within military teams. This questionnaire may be used in future studies to assess teamwork, and in that, prevent a further blurring of constructs due to item overlap or changes in definitions and operationalizations of constructs.

7.3.2 Practical contributions

Besides the aforementioned theoretical contributions, this study also offers several practical implications. First, Salas et al. (2005) claimed that the components in their teamwork model are the most relevant factors with the highest impact on team performance. In addition, they claimed that the components in their model can be developed through interventions. This makes the model a useful tool for improving teamwork in practical settings. The results of this study may give practitioners, such as team supervisors and team members, more insight in the relevant components that comprise teamwork and that these insights may guide their actions on how to most effectively enhance team performance. The results underscore the importance of teamwork for team effectiveness. Moreover, team orientation, backup behaviour, and adaptability deserve special attention because of the effects these teamwork KSAs have on other teamwork KSAs and team effectiveness.

Second, several teamwork KSAs may compensate for team leadership. Teams with team members that are able and willing to help and correct each other, who share the same mental models, who know what team goals to obtain and how to do it together, may have an advantage over teams that rely more on team leaders to get the team going. This is especially relevant for teams that work under dangerous conditions, such as military teams, where teams may lose their team leaders because they get killed or injured in action. In addition, the more team members are able to run themselves, the more the team leaders have the opportunity to focus their attention outwards the team. This may be especially relevant for teams operating in in extremis settings. So, interventions aimed at enhancing teamwork may reduce the team's dependence on team leaders and may strengthen concerted action and self-correction.

Next, teamwork deteriorates over time when teams are deployed. Since teamwork affects team effectiveness, the latter deteriorates when teamwork does. So, additional attention and efforts are needed for teams to sustain, or improve in teamwork when deployed. Several antecedents have been found that may contribute to the team's ability to work together. These antecedents provide for practical points of application for those who are concerned with sustaining, or improving team performance within military teams that are deployed.

For example, enhancing the team's feeling of potency, positively affects team members engaging in task driven interaction. Potency depends on team members' sense that they have what they need to succeed (Shea & Guzzo, 1987a). According to Shea and Guzzo (1987b), a supportive context positively affects potency. Important determinants of potency, they argue, are the availability of resources such as equipment and training (Shea & Guzzo, 1987b). Likewise, Salas, Sims, et al. (2004) mentioned the absence of a supportive organizational context as a contributor to the derailment of team performance which they defined as a significant decline in performance. Hackman (2002) also acknowledged the importance of a supportive context for team performance, and materiel resources being critical for team performance, as did Tannenbaum et al. (1996) who argued that when a team lacks the needed tools and resources this may impair the team's effectiveness. Guzzo and Dickson (1996) also mentioned the technology the team works with as a factor that strongly enables or constrains the team's performance. As was mentioned in section 2.2, military teams are highly dependent on equipment. For military teams, trust in their arms and equipment, and the idea the team has adequate materiel resources may affect the team's potency. Likewise, the team's trust that the team will be adequately logistically supported when performing their tasks is likely to positively affect the team's sense of potency. Indeed, De Jong et al. (2005) found empirical support for a supportive organizational context positively affec-ting potency. So, by providing teams with a supportive context and positive experiences of task completion, its sense of potency can be enhanced, and in that, teamwork as well.

Other antecedents of change, may be affected likewise, and in that, affect teamwork. Improving vertical cohesion with leaders, due to leaders being interested in team members, and attending to team member's needs, is another example. This may sound easy. However, it may be difficult to achieve in situations in which military units are deployed. After all, leaders at all levels are absorbed in multiple tasks, often with high stakes and time pressures. This might lead to leaders being more task

oriented than oriented towards the teams and their members. Nevertheless, support from leaders from all levels, as perceived by team members, is of paramount interest for teams to sustain in effective teamwork.

Another example is the firm integration of teams in their embedding context. Teams that are closely linked to other teams, because they have to work together interdependently, or change experiences and lessons learned, perform better than teams that are less closely linked (Ancona & Caldwell, 1992; Choi, 2002; Gladstein, 1984; Oh et al., 2006). So, by rearranging working procedures that facilitate teams to work more interdependently, and by facilitating opportunities for teams to exchange experiences and lessons learned, teamwork within teams may be stimulated, and teams may be prevented from getting isolated and deprived from signals that teamwork deteriorates.

Finally, aforementioned were interventions aimed at enhancing teamwork. Besides, the factors that were included in this study, specific training and team building activities aimed at enhancing team performance must be mentioned as possible interventions. For example, cross-training, team coordination and adaptation training, and guided team self-correction training are useful strategies in enhancing teamwork (Salas, Nichols, & Driskell, 2007).

> Cross-training refers to a team training intervention in which team members rotate positions during training to develop an understanding of the knowledge and skills necessary to successfully perform the tasks of other team members. Cross-training is assumed to give team members an overall framework for understanding the team's task and how each individual's role is important to it. Team coordination and adaptation training refers to a team training intervention in which team members are trained to alter their coordination strategy and to reduce the amount of communication necessary for successful task performance. Team coordination and adaption training are assumed to help team members learn about specific teamwork skills and how to optimize the value of idle periods when task demands are low by anticipating and discussing potential problems. Finally, guided team self-correction training refers to a team training intervention in which team members learn to diagnose the team's problems and to develop effective solutions. Guided team self-correction training is assumed to foster correct expectations (i.e., shared mental models) among team members, thereby contributing to more effective team performance (Salas, Nichols, et al., 2007, p. 474-475).

Based on their meta-analysis on the effect of these three team training strategies, Salas, Nichols, et al. (2007) concluded that the team coordination and adaptation training improves team performance the most, followed by the guided team self-correction training, and finally, the cross-training. Although it is beyond the scope of this book, to go into detail in these training strategies (e.g., Cannon-Bowers, Salas, Blickensderfer, & Bowers, 1998; Smith-Jentsch et al., 2008; Entin & Serfaty, 1999), it is worthwhile to add these interventions to the 'tool-kit' of those who are concerned with improving team performance. Since team building interventions (i.e., role clarification, goal setting, improving interpersonal relations, and improving problem solving capabilities) improve team performance as well (Klein et al., 2009), these interventions should be part of that 'tool-kit' also.

7.4 Conclusion

Teamwork matters for military teams preparing for, or conducting Peace Support Operations. Teamwork requires for nine KSAs to be displayed by the team members, which are team leadership, team briefing, team orientation, mutual performance monitoring, backup behavior, adaptability, mutual trust, shared mental models, and closed-loop communication. The more team members display these KSAs, the better the team performs on teamwork. Better teamwork leads to military teams being more effective. The more the teams are effective, the more their output meets the demands of those who receive or review it. Moreover, effective teams contribute to the team's viability in that it strengthens cohesion among team members and addresses team members' needs so they feel respected for their contributions to the team.

Moreover, it can be concluded that over a time period of several months, that is between the end of an extensive training period prior to deployment and mid-deployment in Afghanistan or Bosnia-Herzegovina, teamwork in general deteriorates. Team members are less orientated towards their team, are less inclined to support and trust each other, and are less responsive to internal and external changes that may impair the team's effectiveness. Besides the negative effect of time itself, an increase in the team's sense it will be effective, in the social bonding with the team leader and platoon leader, in the intensity and quality with which the team cooperates with other teams, in the feedback the team receives on task performance, and by working in high risk circumstances may account for teamwork to improve over time. Contrary, work getting less challenging and stimulating, may elicit corrective, and motivating actions from the team leader. All these effects on teamwork, as just mentioned, however, are complex. That is, all these factors affect some or most teamwork KSAs, but none affects all. Nevertheless, enhancing the team's confidence that it will be competent, enhancing the social bonding with team leaders and platoon leaders, and firmly integrating the team with other teams, so it can draw on all resources it needs, are effective ways to leverage teamwork.

Now, let us return to the Beluchi valley on the sixth of January, 2007. A Dutch infantry team is fighting its way out of an ambush. The team members are working together intensely to get out of a troubled situation. It is all there … leadership, trust in each other, monitoring each other, helping each other, knowing what to do and what to expect from others, communication, the belief they are all in it together and that they need each other to get out, and the ability to adapt to changing circumstances, both inside and outside the team. In short, teamwork at its best.

Just one example of the hundreds of situations in which the Dutch military had 'Troops In Contact' with 'Opposing Militant Forces', in Afghanistan, in the past years. Fortunately, not all teams that were deployed to Afghanistan or Bosnia-Herzegovina experienced situations like that. Nevertheless, most teams performed under challenging circumstances with team members working together interdependently when accomplishing the team's missions. Whether these teams were medical teams that tried to save the lives of military personnel or civilians, logistical teams that supplied the troops with food, water, fuel, ammunition, and other essentials, maintenance teams that repaired damaged equipment, Provincial Reconstruction Teams that enhanced the security or government in an area, or one of the many other types of teams that were deployed.

How the troops themselves may have experienced the situations they worked in, can perhaps be illustrated by the following. Late 2006, I visited the troops in Deh Rawod as a military psychologist to measure the morale of the troops over there. In the dining facilities, a large poster was hung up that caught my eye. The poster had a picture of the surroundings, and some text on it. It read …

We the willing
Led by the unknowing
Are doing the impossible
For the ungrateful

We have done so much
For so long, with so little
We are now qualified
To do anything with nothing

It is not easy to sustain adequate teamwork within teams in demanding situations over longer periods of time. Yet, it is in those situations that adequate teamwork may make the difference between the team's success or failure. Therefore, the purpose of this study was to provide insights on what teamwork in military teams is about when these teams are deployed, and how teamwork can be developed. The results of this study contribute to the body of knowledge, the military should use to the best of its ability when training teams for teamwork, and when leading teams that are deployed. The teams deserve nothing less, since they do their utmost in making the best out of the worst when necessary.

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Appendices

Appendix A. Examples of handouts

1. MISSIE

Uw missie is de regering van Afghanistan te ondersteunen bij het uitbreiden van het wettige gezag over heel Afghanistan door het creëren en handhaven van een veilige omgeving in Afghanistan.

2. ALGEMENE REGELS

a. Het gebruik van geweld is alleen toegestaan als andere middelen ontoereikend zijn.
b. Gebruik **in alle omstandigheden** niet meer geweld dan noodzakelijk is om uw opdracht uit te voeren en voorkom hierbij zoveel mogelijk bijkomende schade (collateral damage).
c. Het is verboden geweld te gebruiken tegen goederen met een strikt burgerlijk of religieus karakter, tenzij deze goederen worden gebruikt voor militaire doeleinden èn uw commandant ter plekke u daartoe opdracht geeft.
d. Rapporteer ieder gebruik van geweld onmiddellijk aan uw commandant.
e. Verzamel en verzorg de gewonden, ongeacht de groepering waartoe zij behoren.
f. Behandel iedereen met respect en waardigheid, dus ook alle burgers en aangehouden of vastgenomen personen.
g. Voorkom zo mogelijk (vermoedelijke) schendingen van het humanitair oorlogsrecht en de mensenrechten, en rapporteer deze zodra zij zich voordoen aan uw commandant.
h. Neem geen oorlogstrofeeën en cultuurhistorische of archeologische artikelen mee.

3. WAARSCHUWINGSPROCEDURE

a. Bij de uitvoering van uw opdracht kan het noodzakelijk zijn dat geweld wordt gebruikt. Indien u geweld gebruikt dient dit altijd te gebeuren binnen de grenzen van de opdracht en het oogmerk van uw commandant.
b. Als de situatie dit toelaat, bent u verplicht te waarschuwen voordat u geweld gebruikt.
c. Het gebruik van geweld kan bestaan uit gericht vuur.
d. Er dient gebruik te worden gemaakt van het geweld dat het minste schade veroorzaakt.
e. U waarschuwt dat u zult schieten als men niet halt houdt of met de bedreigende handeling ophoudt.
U waarschuwt hoorbaar door te roepen:

"ISAF! STOP OR I WILL FIRE"

en indien mogelijk waarschuwt u zichtbaar door middel van gebaren en/of handelingen, zoals bijvoorbeeld het demonstratief doorladen van uw wapen.
f. Herhaal de waarschuwing zo vaak als nodig en mogelijk is om te bereiken dat de waarschuwing is begrepen.
g. Als aan deze waarschuwing geen gehoor wordt gegeven, mag u in opdracht van de commandant ter plekke, of op grond van de aan u gegeven orders één of meerdere waarschuwingsschot(en) lossen.

Figure 1: *An example of organizational aspects influencing team member's actions. The figure represents pages 2 and 3 from the IK2-5 (Instructiekaart ISAF geweldgebruik [Handout ISAF rules of engagement]; Defensiestaf, 2006).*

IK 2-17, 9e druk

A. COMMANDOVOERING

(Voor bataljonsniveau en lager)

BESLUITVORMING

1. Opdracht
a. Analyse opdracht:
(1) Opdracht en oogmerk twee naasthogere commandanten.
(2) Bezien eigen rol in hoger verband.
(3) Opgedragen en afgeleide deeltaken in tijd en ruimte.
(4) Beperkingen en verplichtingen.
(5) Feiten en veronderstellingen.
(6) Tijdbalk.
(7) Kritieke punten t.a.v. deeltaken en/of tijdsbalk.
(8) Vaststellen (voorlopig) eigen oogmerk (afhankelijk van de situatie).
b. Vaststellen essentiële inlichtingenbehoefte en overige vragen.
c. Vaststellen coördinatiebehoefte.

2. Terugkoppeling en coördinatie
Uitvoeren 1ste CT (a.d.h.v. een eerste analyse van de opdracht).
a. Rol: welke rol vervult de ehd in het plan ter realisatie van de doelstelling van de naasthogere commandant(en) (het waarom).
b. Beoogd effect: waartoe moet het optreden van mijn ehd leiden.
c. Essentiële deeltaken inclusief tijd- en ruimtefactoren.
d. Kritieke punten t.a.v. eigen deeltaken en/of tijdbalk.
e. Essentiële inlichtingenbehoefte.
f. Vragen.
g. Coördinatiebehoefte.

3. Geef een waarschuwingsbevel (op bataljonsniveau in de vorm van een operatiebevel) uit dat tenminste inhoudt:
a. **K:** Komende actie.
b. **V:** Voorbereiding en verplaatsingen.
c. **P:** Plaats en tijd bevelsuitgifte.
d. **O:** Onderbevelstellingen.
e. **G:** Graad van gereedheid/*Notice to move.*

4. Analyse TVOEM
a. **T**errein + Weer:

Terrein	**Weer**
Hindernissen (natuurlijk, kunstmatig)	Licht
Naderingsmogelijkheden (terugtochtmogelijkheden)	Wind
Belangrijke gebieden en beheersende terreindelen	Bewolking
Waarnemingsmogelijkheden en schootsvelden	Neerslag
Vuur- en zichtdekkingen	Temperatuur
	Zicht

b. **V**ijand/partijen.
Mogelijkheden (de **6 W's:** wie, wat, waar, wanneer, waarmee en waarom).
Bepaal: Meest waarschijnlijke en gevaarlijke wijze van vij optreden (hoe).
c. **O**verige aspecten en groeperingen, gerelateerd aan beschikbaarheid tijd.
d. **E**igen middelen (kwalitatief en kwantitatief, organiek en steunend).
e. **M**ogelijke wijzen van optreden vaststellen en de beste kiezen (inclusief risicoanalyse: veiligheid voor personeel en materieel).

Vastgesteld door Commandant Opleidings- en Trainingscommando voor deze C-OTCMan, d.d.: 19-03-2007 bij brief nr. 2007030555

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Figure 2: *An example of environmental factors that may impact a team's courses of action. The figure represents page 1 from IK2-17 (Instructiekaart Commandovoering [Handout Command and Control]; Commandant Opleidings- en Trainingscommando, 2007). This handout presents commanding military personnel (at the level of battalion or below) an overview of key aspects to consider when commanding and controlling military actions. These key aspects are: (1) Mission; (2) Terrain and weather conditions; (3) Opposing Militant Forces; (4) Other parties and other aspects (such as time available); (5) Troops and materiel available; and (6) Possible courses of action.*

Appendix B. Review of sources for the Big Five in Teamwork

Source	Type	Variables	Findings
Bandow (2001)	T	Mutual trust	The author starts by presenting a long list of aspects that may contribute to better performing teams. Among these aspects is trust. Consequently she elaborates on the creation of trust within teams and how to foster it. According to the author, team leaders together with the team members should establish performance standards for individuals and the team, early in the life-time of the team (the first or second team meeting), that serve as a framework for trust. At a minimum, the framework should address issues as how to solve personal and task conflict, how to communicate, and a description of roles, responsibilities and expectations of individual team members. In addition, the author argues that the framework should be written down as a contract that will provide reliability, predictability and consistency (i.e., the essential elements of trust). Although the contract must be amendable, once in place, the contract must be honored and enforced by the team members and the team leader. Finally, the author describes how effective working relations based on trust look like, and what distrust can do to the relationships between team members. Comments: The author does not refer to other publications.
Bandura (1991)	R	Team orientation	Comments: The author presents a comprehensive (96 pages) chapter on the self-regulation of motivation. The aspect of team orientation is not addressed directly nor indirectly.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Brigg (1968)	L	Backup behavior	The authors tested whether fail-stop (preventing a team member committing a failure) and compensatory (countering or correcting a team member's failure after it has been committed) team functions enhance team effectiveness. Moreover, the authors tested whether inter-member communication disrupted task performance. Participants were 32 pairs of male undergraduates who served as radar controllers in a simulated approach control task. The participants were required to alternate in directing aircraft approaches. The prescribed approach rate was 1/minute (high work load) or every 2 minutes (low work load). Participants could compensate for his partner's early or late approaches in compensatory but not in non-compensatory teams. Each team completed 5 sessions, of which the first one was a trial version, and were paid $1,25 per session per team member. The study revealed that both fail-stop and compensatory behaviors augment team effectiveness. However, compensatory behaviors are inversely related to work-load. So, when work-load increases, the ability to compensate decreases. On the other hand, in such situations, fail-stop may prevent team members making errors. Team communication may have a disruptive effect on team effectiveness in situations where there is the least need and the least freedom to communicate. When there is ample time and reason to communicate, team communication neither retards nor enhances team performance. Comments: The Brigg (1968) publication is not mentioned in Salas et al.'s (2005) list of references. Additional searches (Google, Science direct, Omega) did not reveal the article. However, in their list of references is: Johnston, W.A. & Briggs, G.E. (1968). Team performance as a function of team arrangement and work load. *Journal of Applied Psychology*, *52*(2), 89-94. The research findings above concern this publication.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Campion et al. (1993)	F	Adaptability, Team orientation	The study tested whether work design, interdependence, composition, context, and processes influenced team effectiveness. Sample: 80 groups and their managers; from each group 5 members were asked to participate. Jobs were clerical and involved processing paperwork. Response: N = 391 and managers for 77 groups (7 managers rated two teams); 96,1% female; average age 33 years; average tenure 6 years; group members filled out a questionnaire measuring 19 aspects of their work clustered into five domains: work design, interdependence, composition, context, and processes. The 19 determinants, aggregated to the group level, were correlated with objective performance criteria, employee satisfaction, and manager's subjective judgments about team effectiveness. Results: "preference for group work" (part of cluster composition) did not correlate significant with objective effectiveness criteria and manager's judgment about effectiveness; workload sharing correlates significant with objective effectiveness criteria and manager's judgment about effectiveness. Comments: Potency related significantly to all effectiveness criteria; correlations of potency were highest as compared to other process constructs.
Cannon-Bowers et al. (1995)	T	Team leadership, Adaptability, Shared mental models	Based on a review of 27 articles or chapters, the authors identify 74 sub skills for effective teamwork. They cluster these sub skills into eight skill dimensions "common to all (or most) investigations" (p. 347) on effective teamwork. These clusters are: adaptability, shared situational awareness, performance monitoring and feedback, leadership/team management, interpersonal relations, coordination, communication, and decision making. In addition, the authors present a framework of proposed competencies for teams.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Cannon-Bowers et al. (1995) (continued)			This framework distinguishes four types of team competencies; competencies that are context-driven (team-specific and task-specific), team-contingent (team-specific and task-generic), task-contingent (team-generic and task-specific), and transportable (team-generic and task-generic). In this framework, the authors delineate between knowledge (15 constructs), skills (20 constructs), and attitudes (9 constructs) as aspects of the competencies. Comments: Noteworthy is that the authors subsume the sub-skill backing-up behaviors under the skill dimension adaptability. Moreover, it should be noticed that 17 of the sources appeared before 1990 of which 10 of them appeared before 1980. This implies that recent research (from 1990 until 1995, the year the book was published) was not included in the review. Also noteworthy is that Salas was co-author of eight of the 27 articles or chapters that were reviewed. Interestingly, the following constructs that are comparable with the BFT constructs are also mentioned in the framework: Team orientation (morale), collective orientation, mutual trust, belief in importance of teamwork, mutual performance monitoring, compensatory behavior, information exchange, intra-team feedback, cooperation, consulting with others. This chapter, however, is not used by Salas and colleagues as a source for the legitimacy of these competencies in the BFT.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Driskell & Salas (1992)	L	Team orientation	The study examines the effect of collective behavior on team effectiveness. Collective behavior is the "tendency to attend to task inputs from others in a interdependent manner" (p. 278). Participants were 60 male naval technical school students that were 'volunteered' by their commanding officer. The study first distinguished individuals with collective behavior from individuals with egocentric behavior. Participants were therefore grouped into two-person teams that had to work on a decision-making task using a computer. In this task each team member had to formulate an individual solution to the problem. In addition, the team members exchange information (were shown the solution of the other team member on their screen), and as a third step, each team member had the opportunity to reconsider his initial solution and could offer a final team solution. The team members were seated alone in a laboratory room. Data for four persons were missing. This part of the study revealed 19 egocentric individuals, 21 individuals that were collectively oriented, and a group of 16 individuals that were in between. This last group of individuals were dropped from further analysis. In the second phase of the study two-person teams were formed with egocentric participants or with collectivistic participants. Moreover, a third group of participants took part, that did not take part in the first phase of the study. These individuals acted as individuals (no teams). The task resembled the one in the first phase of the study. Following the study, the participants were asked to fill out a questionnaire measuring their satisfaction with working in the team and with the input from their team member. The study revealed that egocentric team members did not improve in effectiveness and that they were less likely to use the information provided by their team mate. Moreover, they viewed the opportunity to work as a team, as well as their partners input, as less valuable than did collectively oriented team members. Collectively oriented teams outperformed their initial individual scores. The authors expect that the importance of collectivistic orientation rises when team task are ambiguous, difficult, or when interdependence in teams is high.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Eby & Dobins (1997)	L	Team orientation	The study tests the effect of several individual characteristics (self-efficacy for teamwork, locus of control, positive past experience working in groups, and need for social approval) on collective orientations of team members. In addition, the study tested the mediating effect of team cooperation (intra-team willingness to reciprocate information and assistance) in the relation team collectivistic composition and team effectiveness. The authors explicitly subsume collective orientation under a group composition variable that affects team processes. Participants were 91 male and 57 female students of an upper level management course. Teams were composed of three to six participants who had to perform a computer-simulated business strategy game. Participants were surveyed prior to the task (individual characteristics and collectivistic orientation) and following completion of the task (cooperation); the teams had 7 – 8 weeks to complete the task in meetings outside of the class. Collectivistic orientation was measured using three items (Cronbach's alpha .68). Team collectivistic orientation was computed by the percentage of individuals with a high orientation. At the individual level of analysis, individual characteristics (except for locus of control) influenced collectivistic orientation. At the group level of analysis, team collectivistic composition affects team cooperation, that in its turn affects team effectiveness.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Hackman & Oldham (1980)	T	Team orientation	In their book, the authors present a normative team effectiveness model for self-managing work-groups. The premise in the book is that several input factors set the stage for effective group performance. According to the model, a supportive context (rewards and objectives for good performance, availability of task-relevant training and technical consultation, clarity of task requirements and constraints), design features (design of the group task, composition of the group, group norms about performance process), and healthy interpersonal processes (coordinating efforts and fostering commitment, weighting inputs and sharing knowledge, implementing and inventing performance strategy) affect intermediate criteria for effectiveness (level of effort brought to bear on the task, amount of knowledge and skill applied to task work, appropriateness of task performance strategies), which in their turn affect team effectiveness (output of the group meets or exceeds organizational standards of quantity or quality, member's needs are more satisfied than frustrated by the group experience, the capability of members to work together on subsequent group tasks is maintained or enhanced). Comments: coordinating efforts and fostering commitment, and weighting inputs and sharing knowledge have a strong overlap with team orientation as the propensity to take other's behavior into account during group interaction and the belief in the importance of team goals over individual members' goals.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Hinsz et al. (1997)	T	Team leadership	The authors review research on how task performing groups process information. The review focuses on "small, interacting, task-oriented groups, typically of the ad hoc, laboratory variety" (p. 44) performing cognitive and intellectual tasks. The authors integrated their findings around the following themes: objectives, attention, encoding, storage, retrieval, processing, response, feedback, and learning. Based on their research, the authors identify four dimensions of variability in group-level information processing. These dimensions are (1) the communality – uniqueness of information; (2) convergence – divergence of ideas; (3) accentuation – attenuation of cognitive processes, and (4) belongingness – distinctiveness of members. Comments: this article is not about team leadership. Besides communication, the only reference to one of the BFT dimensions is shared mental models. The authors conclude that the amount of convincing evidence for the impact of shared mental models on team effectiveness is "still quite meager" (p. 48).
Klein & Pierce (2001)	T	Adaptability	The authors theorize on adaptive teams. Adaptive teams have the ability to change the planned use of resources, to alter their internal team structure, or both. Besides the ability to make these modifications, adaptive teams also know when to adjust (and when not, considering the risks of changing). The authors sum up several factors that enhance the team's ability to adapt (e.g., the situation, available resources, and problem solving abilities) and that reduce team adaptivity (e.g., over training in task routines, highly detailed plans, an organization structure that facilitates centralization). Finally, the authors describe ways to assess team adaptability and provide training principles so teams can become more adaptive (e.g., train to manage more degrees of freedom, develop problem solving routines, develop an ''adaption mindset'', train information-seeking skills).

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Klimoski & Mohammed (1994)	T	Shared mental models	The authors reviewed the literature with the purpose to provide a conceptual foundation for the notion of a team mental model (TMM). According to the authors, a TMM is an emergent characteristic of the group although it can be measured at the individual level. A TMM reflects organized knowledge, internalized beliefs, assumptions, or perceptives "of tasks, of situations, of response patterns *or* of working relationships" (p. 426; emphasis in the original text). The authors argue that there is no value in thinking that there is just one TMM within the team. Multiple mental models may co-exist among team members at a given point in time. A TMM has the function of orienting and coordinating the interaction within teams. Without a TMM, team members have to negotiate reality. Although the authors acknowledge TMM to be a team process, they argue that a strong case can be made by labeling TMM as an input factor (a team characteristic). Finally, the authors argue that TMMs are context dependent and therefore are hard to generalize across situations that differ significantly.
Kozlowski et al. (1999)	T	Adaptability	The authors develop a normative team development model of team compilation that enhances team adaptability. Team compilation is "a process that proceeds across levels and time. It specifies content, processes, and outcomes that are relevant at different levels and at different points along the developmental continuum. It is formulated around a sequence of phases as members make the transition from individual focus to dyadic focus to the team-level focus. [The authors] envision the phases as a series of modal representations of compilation. Each phase is characterized by a particular level of focus, a primary learning process and content domain, and a set of knowledge and performance outcomes that trigger compilation to the next level and phase" (pp. 255-256). Consequently, the theory is outlined in detail. Comments: the chapter comprehensively outlines what must be done at the individual and team level at several points in time, to become an adaptive team. The chapter does not provide empirical evidence on how adaptive teams function and what effect adaptation has on team performance outcomes.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Marks et al. (2001)	T	Team leadership, Backup behavior	The authors argue that teams are multitasking units, which means that teams usually perform several tasks simultaneously. Moreover, the authors argue that in pursuing each task, teams go through two episodes: a transaction phase and an action phase. In the transaction phase, teams focus primarily on evaluation and/or planning activities in order to accomplish the task. In the action phase, teams conduct activities leading directly to task accomplishment. The authors make a strict distinction between interaction processes and emergent states. The latter are "properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (p. 357). Variables as collective efficacy, potency, cohesion, and situational awareness represent member attitudes, values, cognitions, and motivations that are typically emergent states. Following this distinction, the authors provide a taxonomy of ten processes that teams use to multitask effectively. The taxonomy is based on a review of the literature. The ten processes are: (1) mission analysis formulation and planning; (2) goal specification; (3) strategy formulation; (4) monitoring progress toward goals; (5) systems monitoring; (6) team monitoring and backup behavior; (7) coordination; (8) conflict management; (9) motivation and confidence building; (10) affect management. Besides this taxonomy, the authors provide definitions of the processes. Finally, the authors argue that processes 1 – 3 may be used more frequently during transition phases, whereas processes 4 – 7 may be used more frequently during action phases. Processes 8 – 10, however, will be needed equally during both phases.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Mathieu et al. (2000)	L	Shared mental models	The study tested the influence of team member's shared mental models (SMM) on team processes and team effectiveness. The processes are (a) strategy formation and coordination, (b) cooperation, and (c) communication. Participants were 52 male and 60 female undergraduate students (mean age 21 years). By participating, the students earned extra course credit. The participants were randomly assigned to 56 two-person teams. The teams had to "fly" missions using a computer game. The study revealed that two types of SMM can be distinguished: a knowledge structure pertaining task characteristics and a structure pertaining team characteristics. Both SMMs had an effect on team processes and these processes affected team effectiveness. The SMM (team) related significantly to team effectiveness, but the relation was fully mediated by team processes. SMM (task) did not correlate significantly with team effectiveness, but its effect was indirect via team processes. The study revealed that the mental models did not increase in sharedness over time. Team processes did improve over time. Team effectiveness did improve in the initial stages, but in the later stages faded to a level that did not differ significantly from earlier stages.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
McIntyre & Salas (1995)	R	Mutual performance monitoring, Backup behavior, Closed-loop communication	The authors review several studies that were conducted in the Team Evolution And Maturation (TEAM) research program. The studies were conducted with real teams belonging to the US Navy that participated in simulated exercises on board of their respective vessels. In total, thirteen teams (Combat Information Centers) participated with a total of 121 individuals. Several instruments were used to obtain data, among them interviews and questionnaires. The review is divided in three parts. The first part concerns teamwork. Based on the research, the authors identify four essential teamwork behaviors: performance monitoring, feedback, closed-loop communication, and backing-up behaviors. The authors suggest that the latter of these four skills is the most critical to teamwork. According to the authors, these four teamwork behaviors are probably overlooked or underemphasized in past research. Besides these four behavioral indicators of interaction among team members, two attitudinal enabling conditions for interactions in teams are necessary. The first attitudinal condition can be regarded as the team's awareness of itself as a team. The second attitudinal condition can best be understood as team members fostering within-team interdependence. This implies that team members recognize that their success depends on the success of others. In addition, the researchers identify an "ancillary" teamwork behavior which is flexibility. When describing team flexibility, the authors elaborate on cohesiveness that most other researchers identify as a characteristic of effective teams. According to the authors, effective teams sometimes emphasize behaviors that contribute to task completion over behaviors that contribute to team maintenance (that is cohesiveness). This applies especially to military teams.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
McIntyre & Salas (1995) (continued)			Therefore, according to the authors, cohesiveness is not a necessary part of the teams in the study if cohesiveness is defined as consistent positive affect. When defined as team self-awareness and within-team interdependence, however, cohesiveness is an important part of teamwork for the teams in the study. In addition to the teamwork behaviors and attitudes, the authors argue that, based on the results of the study, teams change over time, and that taskwork is distinct from teamwork. The second part of the review is concerned with team leadership. Based on the results of the study, the authors conclude that team leaders: (1) make a difference with respect to the team's performance; (2) vary on level of expertise in the team operation and on readiness to lead a team; (3) must "know their stuff" (p. 35) and be willing to listen to other team members who have special expertise; (4) serve as models of teamwork; (5) have an important task in providing feedback; (6) moderate the degree of successful feedback to the team by their style; (7) are effective when respected by their team members. The third part of the review is concerned with individual team member's roles. Based on the results of the study, the authors conclude that (1) acquisition and mastery of individual task knowledge, skills and abilities is a necessary condition before a team can train on teamwork; (2) some teams pass through team training based on the effort and/or knowledge, skills and abilities of one or few team members and not as a result of teamwork; (3) team members must now the tasks with whom they work. Comments: Remarkably this chapter has not been used to justify the inclusion of team leadership in the BFT since a large part of the review is concerned with leadership.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Porter et al. (2003)	L	Backup behavior	The purpose of the study was to test the impact of legitimacy of need (LON; a situational variable) and personality traits (aspects of probable backup providers and recipients) on assisting team members with high workload. Participants were 284 male and female undergraduate university students. The students were assigned to four-person teams (N = 71). Participants received extra course credit. Moreover, teams that performed within conditions received $40. The teams performed a simulated decision-making task on the computer that lasted about 2,5 hours (clear airspace from enemy planes). One member was (experimentally) overloaded with enemy planes. However, two conditions were possible: in the first, the probable recipient possessed an equal amount of assets as the other team members whereas (high LON), whereas in the second condition, the probable recipient possessed more assets than the other team members (low LON). Prior to the task, participants filled out a questionnaire measuring emotional stability, conscientiousness, agreeableness, and extraversion. Results showed that in situation with high LON, team members provided more backup behavior than in situations with low LON. Probable recipients that were high on conscientiousness, received more backup behavior in high LON conditions, and less backup behaviors in low LON conditions, as compared to all other probable recipients. The same applied for recipients high on extraversion. Moreover, teams that are high on conscientiousness provide more backup behavior than teams low on consciousness, regardless whether the situation (high or low LON). More critically, however, was the composition of the team on emotional stability. Teams that were low on emotional stability provided less backup behaviors. This tendency was most pronounced in situations of high LON. The effects for provider emotional stability were the strongest in effect size. Teams that displayed more backup behaviors were more effective than teams that provided less backup behaviors. The authors, in addition, argue that backup behavior might lead to other team members neglecting their own work. Moreover, backup behavior may lead to redundant as opposed to complementary behavior in teams. Both situations may lead to negative consequences for team effectiveness. Finally, the authors call for more research on the effects of backup behavior on the social aspects of team effectiveness (team viability and member well-being.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Priest et al. (2002)	T	Adaptability	The authors define adaptability as 'the utilization of knowledge, skills, and attitudes that enable members to recognize deviation from expected action and then readjust actions accordingly'(p. 562). Based on a review of the literature, the authors distinguish two important processes that facilitate team adaptability. The first process is shared mental models which are expectations and beliefs that are held in common by team members about their situation and environment. Shared mental models are the primary mechanism for teams to coordinate interdependent action. The second process is feedback which is needed to update the shared mental models.
Salas, Stagl, Burke, & Goodwin (in press)	T	Team leadership	The authors present a comprehensive overview of the teamwork literature. Based on their review, they identified 138 models or frameworks of team effectiveness. The authors sampled eleven of these models, that they regarded as cutting-edge advancements in the literature. Among these eleven models is the Big Five in Teamwork (Salas et al., 2005), albeit in a rudimentary form. That is, as compared to the initial Big Five in Teamwork model, this model presents less interrelations between teamwork KSAs. Based on the eleven models, the authors present a new model, the integrative multilevel framework of team effectiveness. Comments: Salas et al. (2005) refer to Salas, Sims, Burke and Goodwin (in press). The book chapter appeared in 2007. The text above refers to Salas, Stagl, et al. (2007).

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Shamir (1990)	T	Team orientation	The author presents three potential theoretical explanations of individual contributions to collective work efforts. The three perspectives are calculative considerations, moral or value-based considerations, and the expression and maintenance of identities. Calculative considerations exist when the individual is motivated to contribute to the collective work effort due to the extent that individual expects extrinsic or intrinsic rewards resulting from that effort. Besides these considerations, the individual must perceive the collective as being able to attain the results. So, collective efficacy plays a role in considering whether or not to involve in the collective effort since it is not rational to involve in a collective effort if the chances of successful task completion are perceived low. Moreover, the author argues that the rewards may be social rewards, such as social acceptance or rejection, or social acceptance of status or loss of status. Norms and values act as internal evaluative standards of behavior. Both norms and values have rewarding or punishing potential that does not depend on the consequences of the collective action but in the contribution to the collective action itself. Finally, people behave in certain ways in social situations because they wish to express and affirm their self-concept. The author suggests that the three perspectives must be used simultaneously to explain why individuals contribute to collective work efforts. Comments: The article does not directly refer to team orientation as defined by Salas and colleagues. However, team orientation can be regarded an attitude that is part of the individual's self-concept. In that, individuals high on team orientation may be expected to contribute to collectivistic work efforts so they can express and affirm a cherished identity.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Stewart & Manz (1995)	T	Team leadership	The authors develop a typology of four broad categories of leadership behaviors in self-managing teams, based on the leadership theories of Bass (1990) and Hersey and Blanchard (1977). A self-managing team is a work group that "as a whole, [has been] given responsibility and authority beyond that traditionally experienced by line workers" (p. 749). Based on two dimensions (leader power orientation and leader involvement within a team setting), the authors distinguish between powerless leadership (autocratic power orientation/passive involvement), overpowering leadership (autocratic/active), power building leadership (democratic/active), and empowered leadership (democratic/passive). The latter form of leadership is needed for teams to become autonomous and practicing advanced forms of team self-leadership. For empowered leadership to occur, team leaders must share authority, power, and control with their followers instead of seeking sole possession of authority, power, and control. Moreover, team leaders should refrain from active involvement in day-to-day activities and instead focus on modeling self-regulation, boundary spanning (linking the team to the rest of the organization), and reducing uncertainty by regulating environmental influences. It should be noticed, however, that power building leadership should precede empowered leadership. In addition, the authors use Bandura's (1986) Social Learning Theory to develop a model in which personal characteristics of the leader and situational characteristics of the team setting influence a team leader's perceptions of the leadership behaviors this team leader should display. The perceptions lead to leader's goals for a specific leadership approach, which can be overpowering, powerless, power-building, or empowered. Moreover, the authors provide examples of personal and situational antecedents leading to each of the four types of leadership behaviors.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Stout et al. (1999)	L	Shared mental models	The study tested whether team planning influences shared mental models (SMM) and whether these SMM allowed the teams to utilize effective communication strategies. Participants were 40 male undergraduate university students; the participants were offered $50 when participating the study; moreover, the best team was offered a $200 bonus. A team was composed of two participants and two experimenters. The teams had to 'fly' missions using a computer game. Ultimately, six teams were used in the study that planned below average and seven teams were used that planned above average. Compared to the teams that planned worse, the teams that planned better, developed a greater SMM of team member's information requirements. These better planning teams also provided more information *in advance* (that is: not being asked for) in periods of high workload. The team members of these teams were able to anticipate other team member's information needs. Moreover, these better planning teams made fewer errors in times of high workload.
Wagner (1995)	L	Team orientation	The purpose of the study was to test the moderating effect of individualism-collectivism (IC) on the relationships of group size, identifiability (of effort and contribution to the product), and shared responsibility (for the activities and the group product) on cooperation. Moreover, the direct effect of IC on cooperation was tested. Participants were 303 male, and 189 female undergraduate university students (mean age 21 years). Participants received extra course credit when participating. The task was to prepare a presentation as a group. The task took approximately 18 - 20 hours outside of class. Prior to the task, participants filled out a questionnaire measuring IC and demographic variables. Following the presentation, participants filled out a questionnaire measuring IC and other constructs. Also, participants peer-rated their group member's cooperation. The study revealed that IC is a multifaceted construct that subsumes five factors: (1) personal independence and self-reliance; (2) importance of competitive success; (3) preference for working alone; (4) subordination of personal needs to group interest; (5) effects of personal pursuits on group productivity. In addition, the study reveals that small group size, high identifiability, and low shared responsibility (that is, feeling dispensable) are associated with greater cooperation in groups. Moreover, IC has main and moderating effects on cooperation.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Webber (2002)	T	Mutual trust	The author reviews the literature on cross-functional teams (CFT) which she defines as "a small collection of individuals from diverse functional specializations within the organization. These types of teams usually work together for a limited time and typically their members are also members of other teams. They commonly have reporting relationships to functional managers as well as multiple team or project leaders" (p. 201). Based on the premise that effective team processes may emerge from a climate of trust, the author identifies barriers and for the emergence of trust within CFTs. Among these barriers is heterogeneity in the pursuit of goals and values as a consequence of a cross-functional structure. This cross-functional structure may also imply that team members have to report to different, and sometimes multiple, superiors. Functional diversity may also impair mutual trust due to differences between team members in culture, jargon, and personality. Finally, there may be heterogeneity in time that team members spend on the project. Whereas, some team members spend the bulk of their working time on the project, some others may spend a small amount of their time on the project. This may lead to the team members who contribute significantly, impugn the commitment of those that do not. In addition, the author identifies leadership behaviors that leaders should display prior to, and at the beginning of team formation in order to develop a climate of trust in CFTs right from the start. Actions prior to team formation are directed at selecting the right people for the team and gaining top management support. Actions at the beginning of formation are: negotiating expectations with functional leaders, building positive relationships with other team leaders, promoting a shared commitment for the project, and developing and articulating a clear mission for the team.

(continued)

Appendix B (continued)

Source	Type	Variables	Findings
Zaccaro et al. (2001)	T	Team leadership, Shared mental models	The authors take a functional perspective on leadership. According to this perspective, "team circumstances prescribe certain necessary leadership activities for success, while negating the utility of other activities" (p. 455). The authors develop a meta model in which leadership processes (information search and structuring, information use in problem solving, managing personnel resources, and managing material resources) influence four fundamental team processes (team cognitive processes, team motivational processes, team affective processes, and team coordination processes). These four team processes affect team effectiveness. In addition, the authors develop four leader performance models, one for each fundamental team process. In each model, leadership functions affect team processes, that in their turn, affect team effectiveness. The first model outlines leader performance functions on team cognitive processes. In this model, the following leader activities influence shared mental models, collective information processing, and team meta-cognition: sense making, sense-giving, identifying problem needs and requirements, planning, meta-cognitive prompting, developing team members, motivating team members. The second model outlines leader performance functions on team motivational processes. In this model, the following leader activities influence team task cohesion and collective efficacy: planning and goal setting, coordinating performance strategies, developing team members, motivating team members, and providing feedback. The third model outlines leader performance functions on team affective processes. In this model, the following leader activities influence conflict control, team emotion control norms, presence/absence of emotional contagion, and team "emotional" composition: feedback and control, selecting personnel, developing personnel, and utilizing and monitoring personnel resources. The final model outlines leader performance functions on team coordination. These processes are: matching member capabilities to role requirements, offering clear strategies, monitoring environmental changes, providing feedback, and recalibrating actions.

Note. *Type = type of research; F = empirical study in a field setting; L = empirical study in a laboratory setting; R = review of the literature using (some) empirical data; T = theory.*

Appendix C. Instruments

This Appendix presents all items that were used to measure the constructs in the study.

Team leadership

Item #	Item
1	[A] what we should achieve as a team
2	[A] how our team will execute its assignment
3	[A] what means our team can use
4	[A] how we should work together
5	[A] the tasks of the team members are
6	[A] how we should behave as a group
7	[B] clearly indicates when I have to execute other tasks than as ordered in advance
8	[B] corrects me if necessary
9	[B] contributes to a pleasant atmosphere in our team
10	[B] motivates me to execute my tasks well
11	My team leader uses every opportunity to enhance the knowledge and skills of the team

Note. (A) = *Before we execute our team tasks, my team leader clearly explains …; (B) = During the execution of the team tasks my team leader … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Team orientation

Item #	Item
1	[C] we try to learn from each other
2	[C] we take each other's opinions into account
3	[C] we take each other's activities into account
4	[C] the team goals are more important than individual goals
5	[C] we solve any work problems together
6	[C] we know we need each other to execute the team tasks

Note. (C) = *During the execution of the team tasks … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Mutual performance monitoring

Item #	Item
1	[C] we check whether everyone executes his tasks well
2	[C] we ask for explanation when tasks are not performed well or on time
3	[C] we monitor the progress of each other's tasks
4	[C] we give each other directions so the execution of the task can be improved or adjusted

Note. (C) = *During the execution of the team tasks … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Backup behavior

Item #	Item
1	[C] we help each other when we notice someone having problems executing his tasks
2	[C] we help each other when we notice someone having too much workload when executing his tasks
3	[C] we complete each other's work when necessary
4	[C] we give each other directions to help someone else when necessary
5	[C] we take over each other's tasks when necessary

Note. (C) = *During the execution of the team tasks … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Adaptability

Item #	Item
1	Before we execute our team tasks we enhance our skills and knowledge so we are prepared for as much situations as possible
2	[C] we check whether the progress and the way we execute our tasks is as agreed on and planned
3	[C] we as a team flexibly adjust to new situations
4	[C] we as a team solve unexpected problems well
5	[C] we use the available personnel and means depending on the circumstances
6	[C] we are on the alert of everything that might influence reaching our team goals
7	[D] we review what we can learn from the executed tasks
8	[D] we enhance our working strategies when necessary

Note. (C) = *During the execution of the team tasks …;* (D) *After we executed out team tasks … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Mutual trust

Item #	Item
1	[C] we can depend on every team member to execute his tasks with full effort
2	[C] we can trust each other's skills and knowledge
3	[C] we accept each other's remarks about our performance
4	[C] we admit mistakes we make
5	[C] we accept mistakes other team members make
6	[C] we appreciate and respect each other
7	[C] we are open to each other and share information
8	[C] we can depend on team members not to take unnecessary risks
9	[C] we are loyal toward each other

Note. (C) = *During the execution of the team tasks … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Shared mental models

Item #	Item
1	[E] how our team will perform its tasks
2	[E] why we perform our team tasks
3	[E] what tasks I have to perform when and how
4	[E] what tasks my team members have to perform when and how
5	[E] when I have to adjust my tasks to the tasks of my team members
6	[E] when I have to help my team members with their tasks
7	[E] when I may expect help from my team members while performing my tasks
8	[E] how my team members will react in certain situations
9	[E] what other team members are doing

Note. (E) = *During the execution of the team tasks I know exactly … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Closed-loop communication

Item #	Item
1	[F] I will inform the one who gives me the information that I received it
2	[F] I will check with the one who gives me the information whether I understand it right
3	[F] I will ask for explanation when the information is unclear

Note. (F) = *If I receive information while performing our team tasks, … Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Team output

Item #	Item
1	Our team executes its tasks well
2	As a team we are satisfied with the way we execute our tasks
3	Superiors outside our team are satisfied with how we execute our tasks

Note. *Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Cohesion

Item #	Item
1	In my team we get along well
2	In my team we feel responsible for each other
3	I am proud of my team members
4	Our team morale is high
5	In my team we are friendly with each other

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Respect

Item #	Item
1	[G] respect me for the way in which I work with them
2	[G] respect me for my qualities
3	[G] respect me for how I do my job
4	[G] respect my norms and values

Note. (G) = *I have the feeling that my team members … Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Potency

Item #	Item
1	My team members are able to perform their tasks
2	My team members are prepared to fight when necessary
3	Even in the most difficult circumstances my team members will do everything they can to fulfill their task
4	I think that my team members will perform well in a crisis situation
5	In a life-threatening situation, my chances of survival are good with my team members

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Vertical cohesion with the team leader

Item #	Item
1	My team leader will help me when I have personal problems
2	My team leader is committed to us
3	My team leader is honest with us
4	I get along well with my team leader
5	I have confidence in my team leader
6	My team leader is fully committed to his/her task
7	My team leader informs us as fully as possible

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Vertical cohesion with the platoon leader

Item #	Item
1	My platoon leader will help me when I have personal problems
2	My platoon leader is committed to us
3	My platoon leader is honest with us
4	I get along well with my platoon leader
5	I have confidence in my platoon leader
6	My platoon leader is fully committed to his/her task
7	My platoon leader informs us as fully as possible

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Appendix C (continued)

Inter-team cooperation

Item #	Item
1	When necessary or possible, we cooperate well with other teams
2	We exchange our experiences obtained by performing our tasks with other teams
3	We try to learn as much as possible from other teams' experiences

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.*

Satisfaction with job characteristics

Item #	Item
1	I have sufficient responsibilities in my job
2	I can show my worth in my current job
3	I have a challenging and stimulating job
4	My job enables me to take sufficient initiatives
5	I receive sufficient feedback on my job performance

Note. *Response options: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. Item 5 was eventually removed from this scale. This item, however, was used as an indicator of feedback. The variable with the remaining four items was re-labeled challenging work.*

External rating of team output

Item #	Item
1	The team performs its tasks effectively
2	When performing its tasks, the team uses the available means optimally (weapons, communication assets, vehicles, etc.)
3	When performing its tasks, the team makes optimal use of the circumstances (time, weather, terrain, etc.)
4	The team shows that it masters the essential skills and drills for task performance
5	The teams is persistent and remains resilient when performing its team tasks
6	The team is disciplined when performing its team tasks
7	The team members optimally use each other's knowledge and skills when performing team tasks
8	The team members cooperate effectively when performing team tasks
9	All in all, this team performs well

Note. *Response options: 1 = never; 2 = sometimes; 3 = regularly; 4 = often; 5 = always.*

Appendix D. Factor loadings

This Appendix presents the Factor loadings for each item on its respective teamwork or team effectiveness contruct as determined by a CFA. The items were allowed to load on their respective factors only. The factors were allowed to correlate with each other. The analysis was conducted on the combined dataset of Time 1 and 2 (N = 2858).

Construct and item	Unstand	SE	CR	Stand
Team leadership				
7	1.00			.73
8	1.11	.03	38.24	.75
9	1.07	.03	42.53	.83
10	1.15	.03	43.69	.85
11	.99	.03	39.36	.77
Team briefing*				
1	1.00			.80
2	1.17	.02	54.42	.88
3	1.12	.02	54.36	.88
4	1.24	.02	54.66	.88
5	1.24	.02	53.09	.87
6	1.10	.02	46.45	.79
Team orientation				
1	1.00			.81
2	1.02	.02	49.18	.81
3	.98	.02	53.43	.86
4	1.00	.02	46.14	.78
5	1.02	.02	53.75	.86
6	.99	.02	51.32	.84
Mutual performance monitoring				
1	1.00			.78
2	.99	.02	45.72	.82
3	1.08	.02	48.67	.86
4	1.02	.02	48.88	.86

(continued)

Appendix D (continued)

Construct and item	Unstand	SE	CR	Stand
Backup behavior				
1	1.00			.86
2	1.06	.02	61.60	.88
3	1.12	.02	64.28	.90
4	1.00	.02	59.79	.86
5	1.08	.02	62.26	.88
Adaptability				
1	1.00			.77
2	.95	.02	41.24	.74
3	1.01	.02	46.42	.81
4	1.01	.02	48.52	.84
5	1.02	.02	48.66	.85
6	1.01	.02	47.82	.83
7	1.07	.03	38.03	.69
8	1.07	.02	44.35	.79
Mutual trust				
1	1.00			.76
2	1.04	.02	43.87	.79
3	1.16	.03	45.05	.81
4	1.13	.03	42.47	.77
5	1.08	.03	42.18	.76
6	1.17	.02	48.66	.86
7	1.15	.03	45.98	.82
8	1.03	.02	43.93	.79
9	1.13	.02	48.23	.85
Shared mental models				
1	1.00			.81
2	.97	.02	47.75	.79
3	.97	.02	50.56	.83
4	1.03	.02	53.95	.86
5	1.05	.02	53.24	.85
6	1.01	.02	50.56	.82
7	1.01	.02	48.84	.81
8	.88	.02	38.66	.68
9	.92	.02	44.68	.76

(continued)

Appendix D (continued)

Construct and item	Unstand	SE	CR	Stand
Closed-loop communication				
1	1.00			.87
2	.95	.02	43.44	.75
3	.91	.02	46.71	.80
Team output				
1	1.00			.84
2	1.11	.02	48.31	.86
3	.89	.03	35.28	.65
Cohesion				
1	1.00			.74
2	1.13	.03	41.99	.80
3	1.18	.03	43.48	.83
4	1.18	.03	36.16	.70
5	1.01	.03	37.08	.72
Respect				
1	1.00			.86
2	1.07	.02	65.31	.91
3	1.05	.02	64.72	.91
4	.98	.02	53.28	.81
Potency				
1	1.00			.75
2	1.13	.03	41.30	.78
3	1.15	.03	43.06	.81
4	1.16	.03	43.15	.81
5	1.23	.03	43.25	.81

(continued)

Appendix D (continued)

Construct and item	Unstand	SE	CR	Stand
Vertical cohesion with team leader				
1	1.00			.75
2	1.17	.03	41.86	.84
3	1.12	.03	39.34	.79
4	1.13	.03	40.33	.81
5	1.19	.03	42.76	.85
6	1.09	.03	41.10	.82
7	1.11	.03	37.65	.76
Vertical cohesion with platoon leader				
1	1.00			.77
2	1.16	.03	46.69	.87
3	1.11	.03	43.17	.82
4	1.05	.03	40.71	.78
5	1.12	.03	45.44	.85
6	1.05	.02	43.57	.82
7	1.10	.03	41.31	.79
Inter-team cooperation				
1	1.00			.72
2	1.35	.04	37.37	.80
3	1.40	.04	38.83	.86
Challenging work				
1	1.00			.60
2	1.77	.06	30.83	.81
3	1.80	.06	30.74	.81
4	1.40	.05	28.31	.70

Note. *All estimates are significant at p = .000; Unstand = Unstandardized estimates; SE = standard error; CR = critical ratio; Stand = Standardized estimates. * Team briefing items were initial team leadership items 1 through 6.*

Appendix E. Aggregation analyses

		Time 1					
	Composition model	MSB	MSW	*F*	*p*	ICC1	ICC2
Team leadership	D	1.43	.53	2.67	.00	.25	.63
Team briefing	R	1.23	.48	2.57	.00	.24	.61
Team orientation	R	.73	.35	2.10	.00	.18	.52
Mutual performance monitoring	R	.68	.41	1.65	.00	.11	.39
Backup behavior	R	.72	.41	1.77	.00	.13	.44
Adaptability	R	.66	.30	2.22	.00	.19	.55
Mutual trust	R	.76	.34	2.25	.00	.20	.56
Shared mental models	D	.64	.34	1.91	.00	.15	.48
Closed-loop communication	D	.66	.43	1.53	.00	.09	.35
Team output	R	.38	.17	2.20	.00	.19	.54
Cohesion	R	.50	.23	2.20	.00	.19	.54
Respect	D	.30	.25	1.20	.03	.04	.17
Potency	R	.42	.23	1.82	.00	.14	.45
Vertical cohesion with the team leader	D	.52	.19	2.71	.00	.25	.63
Vertical cohesion with the platoon leader	D	.52	.22	2.41	.00	.22	.58
Inter-team cooperation	R	.45	.25	1.80	.00	.14	.44
Challenging work	D	.51	.32	1.57	.00	.10	.36
Feedback	D	1.15	.77	1.49	.00	.09	.33

Appendix E (continued)

	Time 2					
	MSB	MSW	*F*	*p*	ICC1	ICC2
Team leadership	1.60	.60	2.65	.00	.25	.62
Team briefing	1.53	.56	2.71	.00	.26	.63
Team orientation	.93	.43	2.18	.00	.19	.54
Mutual performance monitoring	.86	.50	1.74	.00	.13	.42
Backup behavior	.95	.50	1.92	.00	.16	.48
Adaptability	.97	.37	2.63	.00	.25	.62
Mutual trust	.97	.42	2.31	.00	.21	.57
Shared mental models	.74	.37	1.98	.00	.16	.50
Closed-loop communication	.81	.53	1.52	.00	.09	.34
Team output	.46	.24	1.88	.00	.15	.47
Cohesion	.76	.30	2.51	.00	.23	.60
Respect	.43	.28	1.55	.00	.10	.35
Potency	.65	.26	2.51	.00	.23	.60
Vertical cohesion with the team leader	.59	.27	2.23	.00	.20	.55
Vertical cohesion with the platoon leader	.59	.27	2.18	.00	.19	.54
Inter-team cooperation	.59	.30	1.95	.00	.16	.49
Challenging work	.69	.37	1.88	.00	.15	.47
Feedback	.96	.79	1.22	.03	.04	.18

Note. *D = direct consensus; R = referent-shift consensus; ICC(1) = intraclass correlation 1; F-test is from a one-way analysis of variance (ANOVA); ICC (2) = intraclass correlation 2. For each variable, the mean of the individual responses represented the team score.*

Appendix F. Test for collinearity

Dependent variable	Team leadership		Team briefing		Team orientation		Mutual performance monitoring		Backup behavior		Adaptability		Mutual trust		Shared mental models		Closed-loop communication	
Independent variable	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF	Tol	VIF
Team leadership			.55	1.81	.28	3.59	.28	3.59	.28	3.59	.28	3.59	.28	3.56	.28	3.54	.28	3.59
Team briefing	.53	1.89			.27	3.70	.27	3.75	.27	3.75	.28	3.58	.27	3.74	.27	3.69	.27	3.75
Team orientation	.17	5.97	.17	5.89			.17	5.80	.18	5.48	.17	5.79	.25	4.04	.17	5.96	.17	5.92
Mutual performance monitoring	.35	2.85	.35	2.85	.36	2.77			.36	2.79	.37	2.71	.36	2.81	.36	2.81	.36	2.77
Backup behavior	.24	4.19	.24	4.19	.26	3.85	.24	4.10			.25	4.06	.25	4.06	.24	4.19	.24	4.14
Adaptability	.17	5.96	.18	5.70	.17	5.78	.18	5.67	.17	5.77			.17	5.86	.18	5.46	.18	5.61
Mutual trust	.22	4.55	.22	4.58	.32	3.10	.22	4.53	.23	4.44	.22	4.51			.22	4.53	.22	4.51
Shared mental models	.33	3.02	.33	3.02	.33	3.06	.33	3.02	.33	3.07	.36	2.81	.33	3.03			.33	3.04
Closed-loop communication	.45	2.21	.45	2.21	.46	2.19	.47	2.14	.46	2.18	.48	2.08	.46	2.17	.46	2.19		
Mean	.31	3.83	.31	3.78	.31	3.50	.27	4.08	.28	3.88	.30	3.64	.29	3.66	.27	4.05	.26	4.16
F	140.9		149.4		270.4		100.7		173.7		269.6		195.0		112.5		65.7	
p	.00		.00		.00		.00		.00		.00		.00		.00		.00	
r^2	.72		.73		.83		.65		.76		.83		.78		.67		.55	

Note. *Nine regression analyses were performed with one teamwork KSA as dependent variable and the other eight teamwork KSAs as independent variables. Each column presents the values for tolerance and VIF for the eight teamwork KSAs that were included in the regression analyses as independent variables. In addition, in each column the model fit and explained variance for each regression analyses are presented.*

Appendix G. Formulas for regression analyses as used in Chapter 6

This appendix presents the formulas for the regression analyses that were used in Chapter 6, to analyze the effects of the antecedents of change on teamwork KSAs. In the formulas below, X_{it1} refers to the score on variable X for team i at Time 1. B_0 refers to the value of the constant, whereas $B_{1,2,n}$ refers to the regression coefficient of the first, second, or n-ed variable. The symbol ε_i refers to 'error' for team i. The Y's and X's between brackets refer to respectively the vector of outcomes over time and the vectot of the predictors over time.

Cross-sectional at Time 1	$Y_{it1} = B_0 + B_1 X_{it1} + \ldots + \varepsilon_i$
Cross-sectional at Time 2	$Y_{it2} = B_0 + B_1 Y_{it1} + B_2 X_{it2} + \cdots + \varepsilon_i$
Time-lag	$Y_{it2} = B_0 + B_1 Y_{it1} + B_2 X_{it1} + \cdots + \varepsilon_i$
Long-term exposure	$Y_{it2} = B_0 + B_1 Y_{it1} + B_2 \bar{X}_{it} + \cdots + \varepsilon_i$ with $\bar{X}_{it} = (X_{it2} - X_{it1}) \div 2$
Change-scores	$\Delta Y = B_0 + B_1 Y_{it1} + B_2 \Delta X + \cdots + \varepsilon_i$ with $\Delta Y = Y_{it2} - Y_{it1}$ and $\Delta X = X_{it2} - X_{it1}$
Multi-level	$\begin{bmatrix} Y_{it1} \\ Y_{it2} \end{bmatrix} = B_0 + B_1 \begin{bmatrix} X_{it1} \\ X_{it2} \end{bmatrix} + \cdots + \varepsilon_i$

Appendix H. Fit of regression models

Dependent variable and type of analysis	Model fit				Model fit		Residual	Model improvement			Percentage explained
	F	*p*	*r*	r^2	2LL	*df*	variance	Δ 2LL	Δ *df*	*p*	variance
Team leadership											
Cross-sectional at Time 1	7.79	.00	.56	.32							
Cross-sectional at Time 2	13.36	.00	.69	.48							
Time-lag	8.83	.00	.61	.38							
Long-term exposure	9.86	.00	.64	.41							
Change-scores	8.05	.00	.60	.37							
Multi-level (step 1)					454.51	2	.35				
Multi-level (step 2)					344.92	10	.23	109.59	8	.00	35
Team briefing											
Cross-sectional at Time 1	7.90	.00	.57	.32							
Cross-sectional at Time 2	18.00	.00	.74	.55							
Time-lag	14.11	.00	.70	.49							
Long-term exposure	15.90	.00	.73	.53							
Change-scores	8.79	.00	.62	.39							
Multi-level (step 1)					430.45	2	.32				
Multi-level (step 2)					305.55	10	.20	124.90	8	.00	39

(continued)

Appendix H (continued)

Dependent variable and type of analysis	Model fit				Model fit		Residual	Model improvement			Percentage explained
	F	*p*	*r*	r^2	2LL	*df*	variance	Δ 2LL	Δ *df*	*p*	variance
Team orientation											
Cross-sectional at Time 1	6.97	.00	.54	.29							
Cross-sectional at Time 2	18.80	.00	.75	.56							
Time-lag	3.94	.00	.46	.21							
Long-term exposure	11.52	.00	.67	.45							
Change-scores	13.20	.00	.70	.49							
Multi-level (step 1)					273.40	2	.17				
Multi-level (step 2)					133.03	10	.10	140.37	8	.00	43
Mutual performance monitoring											
Cross-sectional at Time 1	4.41	.00	.46	.21							
Cross-sectional at Time 2	7.04	.00	.57	.32							
Time-lag	3.40	.00	.43	.19							
Long-term exposure	5.18	.00	.52	.27							
Change-scores	6.78	.00	.57	.33							
Multi-level (step 1)					236.43	2	.15				
Multi-level (step 2)					182.47	10	.12	53.96	8	.00	19

(continued)

Appendix H (continued)

Dependent variable and type of analysis	Model fit				Model fit		Residual	Model improvement			Percentage explained
	F	*p*	*r*	r^2	2LL	*df*	variance	Δ 2LL	Δ *df*	*p*	variance
Backup behavior											
Cross-sectional at Time 1	4.50	.00	.46	.21							
Cross-sectional at Time 2	12.88	.00	.68	.47							
Time-lag	5.81	.00	.53	.28							
Long-term exposure	10.14	.00	.65	.42							
Change-scores	4.94	.00	.51	.26							
Multi-level (step 1)					306.23	2	.20				
Multi-level (step 2)					218.12	10	.14	88.11	8	.00	29
Adaptability											
Cross-sectional at Time 1	6.92	.00	.54	.29							
Cross-sectional at Time 2	18.58	.00	.75	.56							
Time-lag	8.77	.00	.61	.38							
Long-term exposure	13.46	.00	.70	.49							
Change-scores	6.80	.00	.57	.33							
Multi-level (step 1)					259.84	2	.16				
Multi-level (step 2)					142.31	10	.10	117.52	8	.00	37

(continued)

Appendix H (continued)

Dependent variable and type of analysis	Model fit				Model fit		Residual	Model improvement			Percentage explained
	F	*p*	*r*	r^2	2LL	*df*	variance	Δ 2LL	Δ *df*	*p*	variance
Mutual trust											
Cross-sectional at Time 1	6.98	.00	.54	.29							
Cross-sectional at Time 2	15.20	.00	.71	.51							
Time-lag	5.01	.00	.51	.26							
Long-term exposure	8.38	.00	.61	.37							
Change-scores	11.69	.00	.68	.46							
Multi-level (step 1)					276.58	2	.17				
Multi-level (step 2)					152.01	10	.11	124.57	8	.00	39
Shared mental models											
Cross-sectional at Time 1	5.16	.00	.48	.23							
Cross-sectional at Time 2	13.45	.00	.69	.48							
Time-lag	6.20	.00	.55	.30							
Long-term exposure	10.87	.00	.66	.44							
Change-scores	10.19	.00	.65	.42							
Multi-level (step 1)					248.73	2	.16				
Multi-level (step 2)					154.92	10	.11	93.81	8	.00	31

(continued)

Appendix H (continued)

Dependent variable and type of analysis	Model fit				Model fit		Residual	Model improvement			Percentage explained
	F	*p*	*r*	r^2	2LL	*df*	variance	Δ 2LL	Δ *df*	*p*	variance
Closed-loop communication											
Cross-sectional at Time 1	2.85	.01	.38	.14							
Cross-sectional at Time 2	10.79	.00	.65	.42							
Time-lag	5.90	.00	.54	.29							
Long-term exposure	9.20	.00	.63	.40							
Change-scores	5.55	.00	.53	.28							
Multi-level (step 1)					235.33	2	.15				
Multi-level (step 2)					170.36	10	.11	64.97	8	.00	23

Appendix I. Results from regression analyses

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Team leadership																		
(Constant)	-.63	.86	.46	-.05	.60	.93	1.76	.89	.05	.46	.85	.59	1.53	.30	.00	3.41	.07	.00
Team leadership (T1)				.32	.08	.00	.51	.10	.00	.30	.10	.00	-.51	.08	.00			
Potency	.32	.19	.09	.15	.14	.29	.07	.20	.72	.01	.21	.95	.18	.13	.17	.19	.11	.10
Vertical cohesion with team leader	.49	.12	.00	.42	.12	.00	.01	.13	.97	.42	.16	.01	.26	.10	.01	.53	.08	.00
Vertical cohesion with platoon leader	.13	.14	.36	.08	.13	.53	.14	.14	.32	.24	.16	.15	.08	.13	.51	.15	.09	.11
Inter-team cooperation	.10	.15	.50	.18	.14	.20	-.16	.16	.32	.06	.19	.75	.31	.13	.02	.20	.10	.05
Challenging work	-.07	.17	.66	-.38	.12	.00	-.24	.17	.17	-.50	.18	.01	-.28	.15	.06	-.27	.10	.01
Feedback	.09	.09	.34	.15	.08	.07	.12	.10	.21	.27	.11	.02	.08	.08	.35	.14	.06	.02
High risk circumstances	.19	.11	.09	.20	.10	.05	.32	.11	.01	.25	.11	.03	.26	.11	.02	.25	.07	.00
Time																-.07	.06	.28

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Team briefing																		
(Constant)	.34	.83	.69	.08	.54	.89	1.15	.75	.13	-.19	.72	.79	1.74	.30	.00	3.61	.06	.00
Team briefing (T1)				.31	.07	.00	.38	.08	.00	.25	.08	.00	-.52	.08	.00			
Potency	.20	.18	.27	.21	.12	.09	.15	.17	.35	.23	.18	.20	.13	.12	.28	.15	.10	.14
Vertical cohesion with team leader	.36	.11	.00	.37	.10	.00	.23	.11	.03	.47	.13	.00	.05	.09	.56	.37	.08	.00
Vertical cohesion with platoon leader	.31	.14	.02	.02	.11	.88	.13	.12	.30	.18	.14	.20	.12	.11	.28	.21	.08	.02
Inter-team cooperation	.14	.15	.36	.23	.12	.06	-.11	.13	.41	.05	.16	.75	.33	.12	.01	.24	.09	.01
Challenging work	-.21	.16	.19	-.33	.11	.00	-.28	.15	.06	-.38	.15	.01	-.08	.13	.55	-.28	.09	.00
Feedback	.05	.09	.58	.12	.07	.09	.14	.08	.08	.20	.09	.03	.02	.07	.78	.12	.06	.04
High risk circumstances	.35	.11	.00	.30	.09	.00	.39	.10	.00	.34	.10	.00	.36	.10	.00	.39	.07	.00
Time																-.04	.06	.48

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Team orientation																		
(Constant)	.17	.58	.77	-.65	.41	.11	.95	.68	.16	-1.16	.59	.05	2.06	.34	.00	3.95	.05	.00
Team orientation (T1)				.15	.08	.05	.30	.11	.01	.09	.09	.30	-.58	.09	.00			
Potency	.39	.13	.00	.43	.09	.00	.17	.16	.27	.54	.15	.00	.38	.10	.00	.42	.07	.00
Vertical cohesion with team leader	.15	.08	.07	.07	.08	.39	-.02	.09	.87	.00	.11	.97	.02	.07	.74	.12	.05	.02
Vertical cohesion with platoon leader	.05	.09	.63	.06	.08	.50	.06	.11	.59	.14	.11	.21	.05	.09	.59	.06	.06	.34
Inter-team cooperation	.12	.10	.25	.42	.09	.00	.25	.12	.04	.38	.13	.00	.33	.10	.00	.28	.07	.00
Challenging work	.22	.11	.05	.03	.08	.70	-.02	.13	.89	.16	.12	.19	.07	.11	.54	.15	.06	.02
Feedback	.05	.06	.40	.00	.05	.96	-.02	.07	.74	-.04	.08	.58	.07	.06	.25	.03	.04	.44
High risk circumstances	-.06	.07	.44	-.04	.07	.57	.07	.09	.41	-.01	.08	.88	.05	.08	.48	-.04	.05	.45
Time																-.15	.04	.00

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Mutual performance monitoring																		
(Constant)	1.32	.54	.02	.71	.52	.17	1.83	.71	.01	.51	.69	.46	1.93	.39	.00	3.72	.05	.00
Mutual performance monitoring (T1)				.34	.09	.00	.47	.12	.00	.35	.11	.00	-.56	.10	.00			
Potency	.25	.12	.04	.08	.11	.46	-.10	.16	.53	.08	.17	.65	.21	.10	.05	.17	.08	.04
Vertical cohesion with team leader	.11	.07	.15	-.03	.09	.74	.01	.10	.90	-.07	.12	.56	-.01	.08	.85	.07	.06	.24
Vertical cohesion with platoon leader	.05	.09	.59	.25	.10	.01	.03	.11	.79	.28	.13	.03	.20	.10	.04	.16	.07	.02
Inter-team cooperation	.04	.10	.67	.19	.11	.09	.08	.12	.50	.17	.15	.25	.16	.10	.12	.11	.07	.12
Challenging work	.09	.10	.41	.04	.10	.68	-.01	.13	.93	.09	.14	.51	-.01	.11	.96	.08	.07	.27
Feedback	.12	.06	.03	-.13	.06	.05	-.02	.08	.82	-.12	.09	.19	-.05	.06	.42	.01	.04	.79
High risk circumstances	.03	.07	.69	.13	.08	.11	.19	.09	.03	.21	.09	.02	.15	.08	.07	.11	.05	.05
Time																-.07	.04	.13

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Backup behavior																		
(Constant)	1.07	.62	.09	-.89	.52	.09	.25	.75	.74	-1.45	.69	.04	1.46	.40	.00	3.90	.05	.00
Backup behavior (T1)				.41	.10	.00	.51	.11	.00	.41	.11	.00	-.42	.10	.00			
Potency	.18	.14	.20	.36	.11	.00	.22	.17	.18	.45	.17	.01	.29	.11	.01	.27	.09	.00
Vertical cohesion with team leader	.21	.09	.01	.09	.10	.32	-.07	.10	.48	-.04	.12	.72	.07	.08	.39	.16	.06	.01
Vertical cohesion with platoon leader	.07	.10	.51	.05	.10	.62	.12	.12	.34	.22	.13	.10	.00	.11	.98	.07	.07	.35
Inter-team cooperation	.07	.11	.54	.33	.12	.00	.19	.13	.16	.24	.15	.12	.29	.11	.01	.25	.08	.00
Challenging work	.10	.12	.42	-.01	.10	.94	-.06	.14	.65	.09	.14	.51	.05	.13	.70	.11	.08	.14
Feedback	.13	.07	.05	-.03	.06	.63	.01	.08	.92	-.02	.09	.81	-.03	.07	.65	.06	.05	.18
High risk circumstances	.02	.08	.78	.01	.08	.89	.10	.09	.28	.05	.09	.60	.10	.09	.26	.05	.06	.38
Time																-.11	.05	.02

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Adaptability																		
(Constant)	.42	.56	.45	-.40	.41	.33	.61	.60	.31	-.84	.56	.14	1.45	.32	.00	3.89	.05	.00
Adaptability (T1)				.41	.08	.00	.56	.10	.00	.38	.09	.00	-.41	.08	.00			
Potency	.33	.12	.01	.11	.09	.24	-.09	.14	.52	.07	.14	.61	.19	.09	.03	.19	.08	.01
Vertical cohesion with team leader	.12	.08	.11	.11	.08	.17	.06	.08	.47	.08	.10	.42	.02	.07	.74	.13	.05	.02
Vertical cohesion with platoon leader	.11	.09	.25	.02	.08	.84	-.01	.10	.92	.11	.11	.31	.03	.08	.71	.06	.06	.32
Inter-team cooperation	.19	.10	.06	.38	.09	.00	.16	.11	.14	.35	.13	.01	.33	.09	.00	.36	.07	.00
Challenging work	.08	.11	.46	.10	.08	.22	.07	.12	.55	.19	.12	.11	.09	.10	.37	.16	.07	.02
Feedback	.09	.06	.12	-.04	.05	.43	.07	.06	.30	.02	.07	.79	-.04	.05	.41	.04	.04	.31
High risk circumstances	.03	.07	.68	.07	.07	.27	.13	.08	.09	.13	.08	.09	.10	.07	.14	.07	.05	.14
Time																-.09	.04	.03

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Mutual trust																		
(Constant)	.53	.56	.34	-.58	.45	.20	1.33	.69	.06	-.35	.66	.59	1.59	.34	.00	3.97	.05	.00
Mutual trust (T1)				.29	.09	.00	.52	.11	.00	.27	.11	.02	-.44	.09	.00			
Potency	.43	.12	.00	.52	.10	.00	-.12	.16	.47	.45	.17	.01	.56	.09	.00	.51	.08	.00
Vertical cohesion with team leader	.15	.08	.06	.03	.09	.73	-.12	.10	.22	-.14	.12	.25	.08	.07	.24	.12	.06	.04
Vertical cohesion with platoon leader	-.04	.09	.69	.06	.09	.48	.09	.11	.42	.14	.13	.29	.07	.09	.44	.02	.06	.78
Inter-team cooperation	.20	.10	.05	.28	.10	.01	.29	.13	.02	.38	.15	.01	.23	.10	.02	.27	.07	.00
Challenging work	.10	.11	.38	-.06	.09	.51	-.04	.13	.78	-.01	.14	.92	-.12	.11	.27	.04	.07	.57
Feedback	.06	.06	.35	.03	.06	.64	-.01	.07	.89	.00	.09	.97	.08	.06	.14	.05	.04	.24
High risk circumstances	-.09	.07	.19	-.10	.07	.18	.14	.09	.11	-.01	.09	.94	.01	.08	.85	-.09	.05	.06
Time																-.11	.04	.01

(continued)

Appendix I (continued)

Dependent variable and independent variables	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Shared mental models																		
(Constant)	.88	.59	.14	.01	.45	.99	1.37	.62	.03	-.18	.57	.76	1.88	.32	.00	3.75	.05	.00
Shared mental models (T1)				.36	.08	.00	.40	.10	.00	.29	.09	.00	-.51	.08	.00			
Potency	.24	.13	.06	.17	.10	.08	.03	.14	.85	.15	.14	.30	.26	.09	.01	.19	.08	.02
Vertical cohesion with team leader	.12	.08	.14	.07	.08	.36	-.02	.08	.78	-.01	.10	.92	.07	.07	.28	.11	.06	.05
Vertical cohesion with platoon leader	.05	.10	.58	.16	.08	.06	.12	.10	.23	.30	.11	.01	.10	.09	.24	.12	.06	.05
Inter-team cooperation	.12	.11	.27	.28	.10	.00	.17	.11	.12	.29	.12	.02	.25	.09	.01	.22	.07	.00
Challenging work	.13	.11	.25	-.07	.08	.40	-.10	.12	.42	-.03	.12	.81	-.03	.10	.78	.06	.07	.34
Feedback	.10	.06	.11	.02	.05	.69	.03	.07	.61	.05	.07	.49	.02	.05	.66	.08	.04	.05
High risk circumstances	.10	.07	.17	.09	.07	.19	.21	.08	.01	.19	.08	.01	.16	.07	.04	.14	.05	.01
Time																.05	.04	.24

(continued)

Appendix I (continued)

	Cross-sectional at Time 1			Cross-sectional at Time 2			Time-lag			Long-term exposure			Change-scores			Multi-level		
Dependent variable and independent variables	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Closed-loop communication																		
(Constant)	1.73	.59	.00	.11	.46	.81	.56	.64	.38	-.61	.58	.30	1.82	.36	.00	4.00	.05	.00
Closed-loop communication (T1)				.39	.08	.00	.52	.10	.00	.39	.09	.00	-.46	.09	.00			
Potency	.24	.13	.07	.00	.10	.99	.04	.14	.75	.05	.14	.71	.06	.09	.49	.09	.08	.24
Vertical cohesion with team leader	.05	.08	.51	.02	.08	.78	-.01	.08	.92	-.01	.10	.94	.06	.07	.44	.08	.06	.17
Vertical cohesion with platoon leader	.16	.10	.09	.30	.09	.00	.07	.10	.47	.38	.11	.00	.18	.09	.05	.25	.06	.00
Inter-team cooperation	.12	.11	.28	.18	.10	.08	.00	.11	1.00	.06	.13	.63	.22	.09	.02	.21	.07	.00
Challenging work	-.01	.11	.93	.09	.09	.32	.24	.12	.05	.32	.12	.01	-.04	.10	.72	.08	.07	.22
Feedback	.03	.06	.69	.01	.06	.88	.00	.07	.98	-.03	.07	.73	.03	.06	.55	.00	.04	.94
High risk circumstances	.03	.08	.66	-.03	.07	.67	-.04	.08	.63	-.01	.08	.92	-.06	.08	.43	.02	.05	.69
Time																-.06	.04	.14

Samenvatting

Samenvatting

Militaire teams worden wereldwijd ingezet tijdens missies om de vrede en veiligheid te bevorderen. Daarbij kunnen teams te maken krijgen met uitdagende en soms levensgevaarlijke situaties. Bovendien duurt een missie soms maanden, waarbij teamleden 24 uur per dag, zeven dagen per week, intensief werken en leven met elkaar. Dit alles vergt veel van de teamleden om met elkaar te kunnen (blijven) samenwerken.

Goede samenwerking binnen teams vereist dat teamleden bepaalde kennis, vaardigheden en attitudes (KVA's) hebben, gericht op het werken in een team. Deze KVA's worden samen vaak aangeduid als teamwork. Teamwork is belangrijk. Hoe beter het teamwork, hoe effectiever het team is. Een effectief team levert een goede output, blijft als team intact, en heeft tevreden teamleden.

Deze studie startte vanuit de intentie een bijdrage te leveren aan goed teamwork in militaire teams die voor langere tijd onder moeilijke omstandigheden moeten werken. De inzichten in teamwork, de invloed van teamwork op teameffectiviteit, en de factoren van invloed op teamwork in de tijd, zijn immers niet geheel duidelijk. In de literatuur zijn bijvoorbeeld vele tientallen KVA's te vinden die tot teamwork worden gerekend. Om een beter inzicht te krijgen, is de volgende centrale onderzoeksvraag geformuleerd:

Welk effect heeft teamwork in militaire teams op de effectiviteit van die teams en hoe houden militaire teams hun teamwork op peil in de loop van de tijd?

Bij het beantwoorden van deze vraag is teamwork bestudeerd in militaire teams tijdens de voorbereiding op een vredesondersteunende missie en tijdens het uitvoeren van die missie. De teams kunnen worden gekarakteriseerd als actieteams. Een belangrijk kenmerk van actieteams is dat de teamleden onderling sterk afhankelijk zijn bij het uitvoeren van hun taken.

In het onderzoek is gebruik gemaakt van een model met acht KVA's die samen de meeste impact hebben op de effectiviteit van teams (Salas et al., 2005). Deze acht KVA's zijn teamleiderschap, teamgerichtheid, wederzijds monitoren, ondersteunend gedrag, aanpassingsvermogen, wederzijds vertrouwen, gedeelde mentale modellen en een bepaalde vorm van communicatie. Het model van Salas et al. (2005) beschrijft ook hoe de KVA's elkaar beïnvloeden, en hoe ze samen van invloed zijn op de teameffectiviteit. Naast het model zijn aanvullende inzichten uit de literatuur gebruikt om meer duidelijkheid te krijgen over de onderlinge relaties tussen de acht teamwork KVA's en tussen teamwork en teameffectiviteit.

De literatuur is ook bestudeerd om een beeld te krijgen van mogelijke factoren van invloed op de ontwikkeling van teamwork in de tijd. Volgens bepaalde theoretische inzichten ontwikkelen teams zich via verschillende stadia naar een eindfase met routinematige gewoontes. Deze eindfase wordt ook wel aangeduid als robuust evenwicht. In deze eindfase hebben teams een min of meer vaste sociale structuur en vaste interactiepatronen ontwikkeld. Een belangrijke wijziging in de context waarin het team optreedt, kan een aanleiding zijn dat het robuuste evenwicht verstoord raakt, en dat teams nieuwe routinematige gewoontes ontwikkelen. De overgang van de trainingssituatie naar het optreden in een missiegebied kan zo'n belangrijke contextwijziging zijn. Het werken onder risicovolle omstandig-

heden, de ervaringen met het werk (uitdagend werk en feedback), de samenwerking met andere teams (inter-team samenwerking), en de omgang met leidinggevenden binnen en buiten het team (verticale cohesie) zijn daarbij mogelijk van invloed op teamwork. Ook het vertrouwen van teamleden dat hun team in staat is de taken adequaat uit te kunnen voeren (teamvermogen), kan van invloed zijn op teamwork.

Gebaseerd op de literatuurstudie zijn 24 hypotheses opgesteld over de relaties tussen teamwork KVA's en teameffectiviteit. Daarnaast zijn vijf hypotheses opgesteld om de verandering van teamwork in de tijd te kunnen verklaren. Om de hypotheses te kunnen toetsen, is bij teamleden een vragenlijst afgenomen. In de lijst zijn vragen gesteld over de mate waarin binnen de teams de acht teamwork KVA's worden uitgevoerd of ervaren, en hoe men de teameffectiviteit inschat. Ook zijn vragen gesteld over de ervaring van de teamleden met de factoren van invloed op teamwork. Verder is bij (plaatsvervangend) pelotonscommandanten die leidinggeven aan meerdere teams een vragenlijst afgenomen met het doel de tevredenheid met de output van de teams vast te stellen. De vragenlijsten voor teamleden en (plaatsvervangend) pelotonscommandanten zijn op twee momenten afgenomen. Het eerste meetmoment was aan het eind van de opleidingsperiode, kort voor aanvang van de missie. Het tweede meetmoment was halverwege de missie. De tijd tussen beide meetmomenten bedroeg circa vijf tot zes maanden. De deelnemers aan het onderzoek behoorden tot eenheden die deelnamen aan een missie in Afghanistan of Bosnië-Herzegovina.

Op basis van de gegevens van 236 teams (meetmoment 1) en 208 teams (meetmoment 2) bleek dat de kern van teamwork als volgt kan worden beschreven. Meer teamgerichtheid leidt tot meer ondersteunend gedrag binnen teams en meer ondersteunend gedrag leidt tot meer aanpassingsvermogen binnen teams. Meer ondersteunend gedrag en aanpassingsvermogen binnen teams leidt tot een hogere teameffectiviteit. Dus, hoe meer teamleden er meer van overtuigd zijn dat ze samen moeten werken, ze openstaan voor elkaars inbreng, en ze teamdoelen boven eigen doelen stellen (teamgerichtheid), hoe meer teamleden elkaar helpen, zowel fysiek als mentaal, door taken af te maken, taken over te nemen, taken te herverdelen, of door elkaar te steunen (ondersteunend gedrag). Door meer ondersteunend gedrag zijn teams beter in staat om in te spelen op wisselende omstandigheden binnen en buiten het team (aanpassingsvermogen). Door elkaar te ondersteunen en zich als team aan te passen aan wisselende omstandigheden, wordt ervoor gezorgd dat alle teamtaken worden vervuld en dat het team gericht blijft op het behalen van de teamdoelen (output). Dit draagt ook bij aan gevoelens van onderlinge verbondenheid, trots en kameraadschap (cohesie) en respect. Oftewel, het draagt er aan bij dat teams intact blijven en teamleden tevreden zijn.

Opmerkelijk is dat de rol van de teamleider zich voornamelijk uit in het bijdragen aan gedeelde mentale modellen binnen het team en het beïnvloeden van het aanpassingsvermogen van het team, en niet zoals verwacht, in het beïnvloeden van het monitoren en ondersteunen van elkaar. Een mogelijke verklaring hiervoor is dat als teamleden elkaar goed monitoren en ondersteunen, de noodzaak verdwijnt voor de leider om deze taken uit te voeren. Deze activiteiten van de leider worden min of meer gedeeld door de teamleden. Verder bleek de invloed van het wederzijds monitoren, het wederzijds vertrouwen, de gedeelde mentale modellen, en de communicatie beperkt. Daarnaast bleek uit de onderzoeksresultaten dat teamwork wordt beïnvloed door een factor die niet in het model was opgenomen. Deze factor zorgt ervoor dat het aanpassingsvermogen van teams toeneemt, terwijl daardoor de mogelijkheid om elkaar te ondersteunen afneemt. (Of andersom, het aanpassingsvermogen neem af, terwijl de mogelijkheid om elkaar te ondersteunen toeneemt). Verondersteld wordt dat deze factor taakspecialisatie is. Als teamleden (sterk) verschillen in de kennis of vaardigheden die ze hebben, dan zal de variëteit van taken die het team aankan waarschijnlijk toenemen en daarmee het aanpassingsvermogen. Echter, de mogelijkheid om elkaar te ondersteunen binnen het team zal door taakspecialisatie afnemen.

Op basis van de gegevens van 144 teams is de ontwikkeling van teamwork en de invloed daarop van tijd, teamvermogen, verticale cohesie, inter-team samenwerking, uitdagend werk, feedback en het werken in risicovolle omstandigheden bestudeerd. De respondenten in deze 144 teams namen allen deel op beide meetmomenten. Uit de resultaten bleek dat tijdens het verloop van de missie, de teamgerichtheid, het ondersteunend gedrag, het wederzijds vertrouwen en het aanpassingsvermogen binnen teams afneemt. Een mogelijke verklaring is dat in de loop van de missie de steun voor teamdoelen afneemt, de betrokkenheid bij de thuissituatie (via allerlei communicatiemiddelen) toeneemt en de communicatie binnen het team afneemt. Hierdoor raken teamleden minder betrokken op elkaar en het team wat ten koste gaat van het teamwork.

Daarnaast bleek een toename in het vertrouwen dat teamleden hebben in het kunnen uitvoeren van de teamtaken (teamvermogen), een toename in de binding met leiders binnen en buiten het team (verticale cohesie), een toename in de samenwerking met, en het leren van, andere teams (inter-team samenwerking), een toename in feedback op de manier waarop taken worden uitgevoerd, en het werken onder risicovolle omstandigheden een positief effect te hebben op de ontwikkeling van teamwork KVA's. Echter, het beïnvloedingspatroon was complex waarbij alle factoren enkele teamwork KVA's beïnvloedden, maar geen enkele factor beïnvloedde alle teamwork KVA's. Teamvermogen, verticale cohesie met de teamleider en inter-team samenwerking beïnvloeden echter de meeste teamwork KVA's. Verder bleek dat naarmate teamleden hun werk als meer uitdagend ervaren, er minder teamleiderschap wordt ervaren. Een mogelijke verklaring hiervoor is dat naarmate teamleden aangeven dat ze meer kunnen laten zien wat ze waard zijn in uitdagende en stimulerende situaties, en dat ze meer initiatief kunnen tonen en verantwoordelijkheid kunnen nemen voor hun acties, er minder noodzaak is voor teamleiders om teamleden te motiveren en hen aanwijzingen te geven.

De studie biedt enkele belangrijke inzichten voor hen die betrokken zijn bij de opleiding en training van teams, of die leiding geven aan teams. Allereerst blijkt dat het verbeteren van de teamgerichtheid een belangrijke bijdrage kan leveren aan het verbeteren van teamwork, en daarmee, de effectiviteit van teams. Teamleden moeten dus open kunnen staan voor elkaars inbreng en mening, zich realiseren dat men elkaar nodig heeft, en ervan overtuigd zijn dat teamdoelen prevaleren boven persoonlijke doelen. Ten tweede blijkt het verbeteren van ondersteunend gedrag een belangrijk aangrijpingspunt om teamwork te verbeteren. Teamleden moeten bereid en in staat zijn om elkaar te helpen, om taken te (her)verdelen of over te nemen van elkaar als dat nodig is, en om elkaar aanwijzingen geven. Tot slot biedt het vergoten van het aanpassingsvermogen een belangrijk aangrijpingspunt om teamwork te verbeteren. Teamleden moeten kunnen beoordelen of de uitvoering van de teamtaken gaat zoals gepland. Teamleden moeten ook in staat zijn om te kunnen inschatten of factoren (binnen of buiten het team) de taakuitvoering van het team beïnvloeden. Zo nodig moeten teamleden in staat zijn om zich flexibel aan te passen aan wijzigende omstandigheden en om onverwachte problemen te kunnen oplossen. Verder moeten teamleden in staat zijn om te reflecteren op uitgevoerde taken en waar nodig lering te trekken uit die reflectie.

Verder blijkt dat de teamgerichtheid, het ondersteunend gedrag, het wederzijds vertrouwen, en het aanpassingsvermogen binnen teams in de loop van de missie vermindert. Dus, om teamwork op peil te houden of te verbeteren, is extra aandacht voor deze aspecten nodig. Met interventies, zoals teambuilding en het trainen van elkaars taken kan teamwork worden verbeterd. Ook kan teamwork worden verbeterd door teams te (de)briefen waarbij teamleden zelf de verantwoordelijkheid krijgen om het functioneren van het team te diagnosticeren volgens het model van teamwork. Tijdens de (de) briefings leren teamleden op een gestructureerde manier naar teamwork binnen het team te kijken en eventuele problemen op een constructieve manier op te lossen. Verder kan het trainen van coördinatie en communicatievaardigheden bijdragen tot beter teamwork.

Tot slot is een stimulerende context voor teams een belangrijke voorwaarde om teamwork op peil te houden tijdens missies. Positieve ervaringen met de taakuitoefening en met het materieel waarmee men werkt, en een adequate (logistieke) ondersteuning vanuit de organisatie vergroten het vertrouwen in de effectiviteit van het team hetgeen leidt tot beter teamwork. Ook een goede binding met leidinggevenden, en goede samenwerking en kennisuitwisseling met andere teams vertaalt zich in beter teamwork.

Over de auteur

Over de auteur

Jacco Duel (Schoonhoven, 1964) behaalde in 1981 zijn havo diploma aan het Christelijk Lyceum in Almelo. Aansluitend begon hij de opleiding tot officier bij de Koninklijke Landmacht via het Opleidingscentrum Officieren Speciale Diensten en het Artillerie Opleidingscentrum in Breda.

Van 1983 tot 1994 vervulde hij diverse functies in de rang van luitenant en kapitein bij verschillende afdelingen en scholen van de veldartillerie. Zijn laatste functie in die periode was commandant van een vuurmondbatterij bij de 154e Afdeling veldartillerie. Van 1990 tot 1992 volgde de auteur in de avonduren het vwo in Harderwijk.

Van 1994 tot 1998 volgde hij als kapitein de officiersopleiding via de Koninklijke Militaire Academie, en aansluitend de opleiding stafdienst via het Instituut Defensie Leergangen. In zijn vrije tijd volgde hij de wetenschappelijke opleiding Arbeids- en Organisatiepsychologie via de Open Universiteit. Deze studie rondde hij in 1998 af na een stage van tien maanden bij de Afdeling Gedragswetenschappen van de Koninklijke Landmacht. Daar deed hij onderzoek naar het opleidingsverloop bij de schoolbataljons van de landmacht.

In september 1998 werd hij bevorderd tot majoor en ingedeeld bij het dienstvak van de Militair Psychologische en Sociologische Dienst van de Koninklijke Landmacht. Eind 1998 werd hem het brevet Hogere Gedragswetenschappelijke Vorming toegekend door de Bevelhebber der Landstrijdkrachten. In de periode van september 1998 tot juni 2004 heeft hij diverse gedragswetenschappelijke functies vervuld bij Defensie Werving en Selectie (psychologische selectie van – aanstaand – militair personeel), het Commando Opleidingen Koninklijke Landmacht (beleid ontwikkelen over de integratie van civiel en militair onderwijs) en, als luitenant-kolonel, bij de staf van de Koninklijke Marechaussee (hoofd sectie Gedragswetenschappen).

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Jacco Duel is getrouwd met Petra van der Molen en samen zijn zij de trotse ouders van zoons Aart (1993) en Jaap (1994) en dochter Silke (1998).